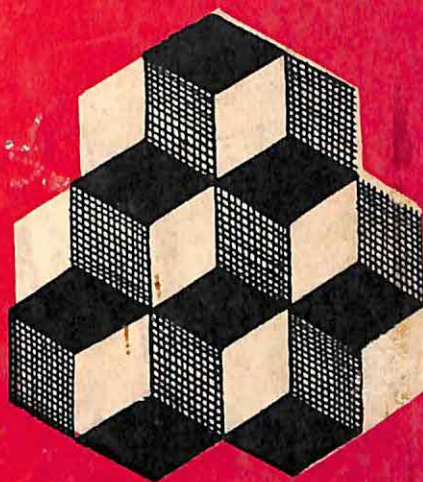


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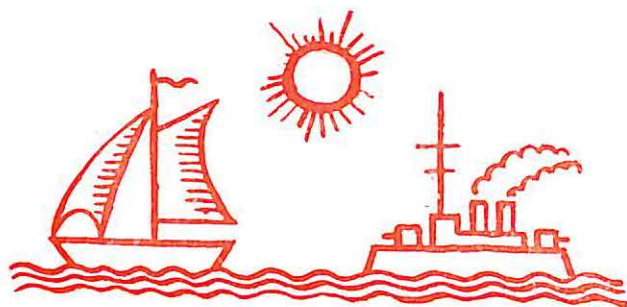
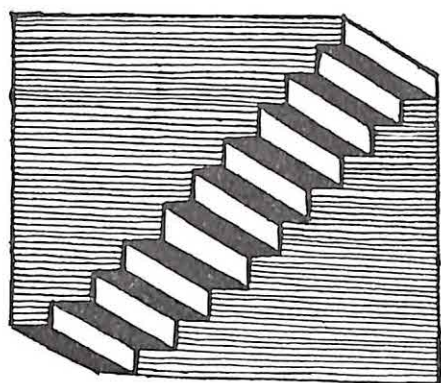
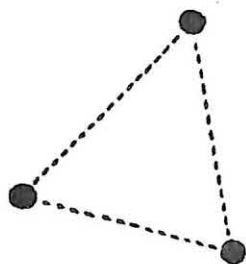
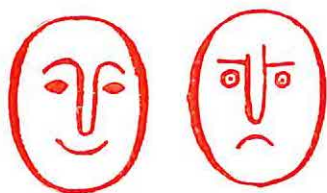
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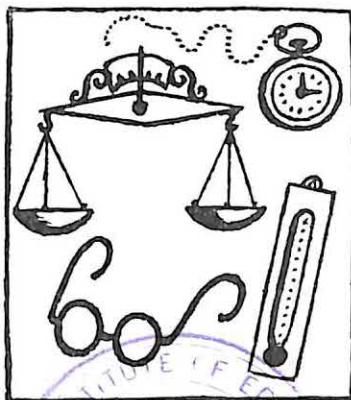




K. PLATONOV

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PSYCHOLOGY AS YOU MAY LIKE IT



PROGRESS PUBLISHERS

Moscow



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This is not a textbook of psychology, nor even merely a popular exposition of old truisms.

The author, a well-known psychologist, has collected in this book a large number of questions of interest to young people and has answered them briefly, popularly, entertainingly and in keeping with modern knowledge.

To be sure, is there anyone in our days who may not wonder what the people of the coming communist society will have to be like? Or may not care to learn how to develop the will, memory and attention? Or may not want to know what conscience, duty and love are from the standpoint of psychology? Or may not be interested in whether telepathy is possible, whether or not dogs and ants have consciousness, what are dreams, and so on and so forth?

The text includes some of the simplest psychological experiments which any reader can perform and which are conducive to a better understanding of the laws governing mental activity and manifesting themselves in work and everyday life.

The book is intended for the broadest circles of readers.

19.7.93
7084

First printing 1965

К. К. ПЛАТОНОВ

ЗАНИМАТЕЛЬНАЯ ПСИХОЛОГИЯ

На английском языке



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LET'S GET ACQUAINTED

I have known many of you for a long time.* It is you who have taken the most active part in the discussions on "Concerning the Personality Traits of the New Man", "Concerning Conscience and Duty", "Time and I", and "Concerning the Moral Code of the Builders of Communism" held not only at clubs, but also on the pages of newspapers and magazines. It is you who in lecture halls and in confidential talks, during promenades and in letters questioned me about the nature of mental activity.

It often turned out that the phenomenon you considered a riddle of consciousness had long been explained by the science of psychology, and what appeared self-evident to you was still unfathomed.

In my answers I wanted to show that the mysteries of our mind are quite cognisable, that they are becoming fewer and fewer, and that the chances for applying the theory of psychology to practice are continuously increasing.

However, I have not always been able to satisfy your curiosity and that is why I decided to write a book on psychology of everyday life, on the properties of consciousness which manifest themselves at every step, and on the mental traits of the new man—the builder of communism. Moreover, I wanted this book not only to contain useful facts, but also to make entertaining reading. Aren't there, in addition to textbooks of physics, geometry, mineralogy, astronomy and zoology, also books entitled *Physics for Fun*, *Entertaining Geometry*, *Mineralogy for Everyone*, *Astronomy Made Easy*, *Zoology for Amusement*, etc.? Isn't it at all possible to tell the story of psychology more entertainingly than it is told in textbooks?

* The author is, of course, addressing himself to Soviet readers.—Ed.



In this book I have not invented a single question and have dealt only with the questions I was asked, merely changing the form of some of them. The questions are treated in the same sequence as they are in textbooks of psychology. I think this will facilitate the reading of the book, although, incidentally, you do not have to read it in any regular sequence, and may start anywhere you please.

The book consists of short stories—sometimes amusing and sometimes serious, descriptions of experiments, literary excerpts, brief answers to questions, various examples, and explanations of the illustrations.

Each story answers some question and explains some law of psychology. That is why the book offers definitions of the basic concepts of psychology.

Some of the problems discussed in the book agitated the minds of people thousands of years ago. The striving to explain mental phenomena engendered science, as well as religion and superstition. Wherever science advanced, religion had to retreat. However, many superstitions are still nursed by people who do not know their origin. For lack of knowledge it may sometimes appear that man's mental activity is not wholly governed by objective laws. Scientific explanations of phenomena which are sometimes considered mysterious must help in the fight against superstitions and prejudices. This was uppermost in my mind when I was writing this book.

I should also like the general information on psychology presented in this volume to stimulate in my readers a serious interest in this fascinating science.

Now *open the book on page 174 and read* the story at the top of the page. I am asking you to do this, although I have no doubts that you *will* do it. The italics will attract the attention of those who have not read the preceding text. Noticing the italicised sentence they will surely become interested in the story printed on page 174. It's like the New Year's Eve games in which the players are repeatedly told: "Now look there for it."

But, please, do not read the story on p. 201 just yet.

I think we have now become acquainted.

Chapter 1

RIDDLES OF THE CONSCIOUSNESS



TWO YURIS

What appears an unfathomable riddle to one person is simple and intelligible to another.

Yuri Langada, operator of a gantry-crane and a remarkable worker, worked at the construction of the Bratsk Hydro-electric Power Station. Once some foreign visitor asked him:

"What made you come to Siberia?"

"My conscience," answered Yuri. "I knew I was needed in Siberia more than in Moscow."

At the press conference dedicated to man's first successful cosmic flight in the spaceship *Vostok* some representative of the capitalist press used the word "sent" in his question. Yuri Gagarin corrected him by saying:

"In this question I should like to replace the word 'sent' with the word 'entrusted', and this trust makes me very happy and proud."

PLAIN SOVIET PEOPLE

At the beginning of 1960 a storm drove a barge with four soldiers on board away from the Kurile Islands. After a forced 49-day drift over the waves of the Pacific Askhad Ziganshin, Philip Poplavsky, Anatoly Kryuchkovsky and Ivan Fedotov were rescued and brought to San Francisco. To many Americans these plain Soviet boys became a riddle.

And here is a characteristic interview they gave a foreign journalist:

Journalist: I know that under the circumstances one may become inhuman, lose one's mind, become a beast. Of course, you must have wrangled, maybe even fought over the last piece of bread, the last mouthful of water.

Ziganshin: In all the 49 days the members of the crew did not say one rude word to each other. When the drinking water was coming to an end each of us received half a glassful a day. And not one of us drank another drop. Only when we celebrated Anatoly Kryuchkovsky's birthday we offered him a double portion of water, but he turned it down.

Journalist: In that inferno you remembered your comrade's birthday? That sounds incredible! And didn't you think of death, Mr. Ziganshin?

Ziganshin: No, we didn't. We thought we were too young to give up so easily.

Journalist: How did you while your time away? For example, you, Mr. Poplavsky?

Poplavsky: We sharpened fish-hooks, cut spoon-bait out of tin cans, untwined ropes and made fishing-lines. Askhad Ziganshin repaired the signal lamp. Sometimes I read a book aloud.

Journalist: What book did you read?

Poplavsky: Jack London's *Martin Eden*.

Journalist: This sounds incredible!

Fedotov: Sometimes Philip played the accordion and we sang.

Journalist: Let me see this historical accordion.

Fedotov: Much to our regret, we ate it.

Journalist: What? What do you mean, you ate it?

Fedotov: Just what I said, we ate it. It had leather parts. We ripped the leather off, cut it up and cooked it in sea-water. It was sheepskin and we even jested about having two grades of meat: first grade—the accordion leather, and second grade—the leather from our boots.

Journalist: And you could still jest? That's more than I can understand! Do you yourselves know what sort of people you are?

Ziganshin: Why, we're just plain Soviet people.

TIME, CONSCIOUSNESS AND I

In this case I am not merely I, the author, but also I, the reader. And not only because the author is old and the reader is young, but also because this book was written for the reader and about the reader.

Time is gathering speed. Karl Marx wrote that it required thousands of years for hunger which made people devour raw meat rent with the hands, nails and teeth to become hunger-satisfied with cooked meat eaten with the aid of a knife and fork. Frederick Engels wrote that it took centuries for the sexual love of the ancients to acquire the moral criterion of reciprocity. But it took only decades of the socialist system, for example, radically to change the attitude to woman in the Central Asian Republics, to transform labour from a dire necessity to a joyous need, to make the

average Soviet worker more intellectual than the average bourgeois intellectual. And this process is gathering momentum before our very eyes. The time in which we live has shouldered all the heritage of the past; at the same time we already clearly see our communist future in our socialist present.

The consciousness of each and every one of us therefore not only reflects our present, but has also accumulated all the past and is aspiring to the future.

In different people the various manifestations of consciousness either correspond to the present day, bear the stamp-survivals-of the past, or run ahead of time. And this may be observed in everything—the interests and aspirations, the world outlook and behaviour, the habits and character.

But I want my consciousness to rid itself of the bad heritage of the past and to take from the past only that which is good for the future. I want it not only to keep up with the time, but also to run ahead of it and to bring my future into my present. I want to help you, too, with it. And here is somebody who wants to help both of us. The more a person strives for this, the more conscious he is said to be. It is no accident that the word "consciousness" was derived from the Latin *consci-us*—knowing, for the more extensive and deeper the knowledge of a person, the clearer and richer his consciousness and the more conscious the person himself.

CAN THERE BE A SCIENCE ABOUT SOMETHING THAT DOES NOT EXIST?

One of my young friends once asked me:

"What does the term 'psychology' mean and when was it coined?"

I told him that the term came from the Greek *psyche*—soul, and *logos*—word, and meant the science of the soul. In scientific literature this term occurred as early as the 10th century, but was officially introduced by the German philosopher Christian Wolff comparatively recently, in the second half of the 18th century, when psychology was set apart as an independent branch of knowledge.

Attempts to gain an insight into the human mind date from time immemorial. The first systematic exposition of psychological facts was made by Aristotle (384-322 B.C.) who generalised the knowledge concerning man's spiritual life accumulated by that time. He entitled his treatise *De Anima* (*On the Soul*). Much later the Roman physician and naturalist Claudius Galen who lived at about 130-200 A. D. tried to prove with experiments on animals that the brain is the organ of sensations and thinking. He believed the spiritual processes to be operated by a psychic

pneuma (*pneuma*—Greek word signifying the vital spirit, soul) which circulates through the nerves, the latter transmitting the sensations from the sense organs to the brain whence "orders" are sent to the motor organs.

"But it is well known that neither man nor animals have any soul. How then can there be a science about something that does not exist?" my interlocutor wondered.

I had to agree that there could be no science about anything that does not exist. But the names of sciences formed historically; although their subject matter continuously changes it would make no sense to change the names. Moreover, many sciences would have to be given new names. The subject matter of physics is only part of natural science, although the term stems from the Greek word *physis*—nature, while geometry has long since ceased to be concerned merely with land measuring.

Of course, there is no soul as it is conceived idealistically or religiously. However, spiritual or, to be exact, mental processes, such as consciousness, sensation, perception, conception, thinking, emotions and volition, do exist. Aristotle, too, had described in his treatise real mental phenomena and not an abstract soul that was later borrowed by Christianity which greatly misrepresented Aristotle's views.

Idealists have always maintained that the mind is a manifestation of some primary spiritual principle independent of matter. Dialectical materialism avers that the mind is secondary since it owes its origin to matter, and that such phenomena as being, matter and nature are primary.

The history of psychology is the history of the struggle of materialism against idealism and of its victory over idealism. Whatever the details of a world outlook, in the end all world outlooks may be divided into two groups. If a person holds that the surrounding world exists only in his consciousness, he is an idealist. If he believes the world and nature to exist outside and independently of his consciousness, he is a materialist. In a word, being is primary for the materialist, consciousness—for the idealist.

Many errors were made in the attempts to understand mental phenomena. For example, Spinoza (1632-1677), a Dutch materialist philosopher and atheist, believed thinking to be an eternal property of all matter. The philosophy of psycho-physical parallelism, according to which mental and physiological phenomena occur independently of and concomitantly with each other, has become very popular since the middle of last century. Since the beginning of our century behaviourism has gained considerable ground in American psychology; this reactionary trend denies consciousness and man's conscious activity, and reduces psychology to a mere study of behaviour as a result of the organism's response reactions to

stimuli. Man is considered an automaton. Some scientists, representatives of so-called functional psychology, held that the mind was divided into separate independent functions; others (Geshalt psychologists) regarded every mental process as a configuration or pattern.

Psychology in its modern materialist interpretation is a science that studies the mind, i.e., the ability of the brain to reflect objective reality.

All the mental phenomena studied by psychology may be divided into three groups:

a) mental processes (for example, any human being may become angry or manifest inattention);

b) mental states (for example, under the influence of overwork man may for a long time become irritable or inattentive, these states passing off after a rest);

c) personality traits (for example, the same irritability or inattention may be traits of the character and will have to be eliminated, not by rest, but by education).

Of the very many practical objectives of psychology the two most important ones are: to help in the all-round development of man's personality and to facilitate man's work.

But the term "psychology" also has another meaning. People speak of "peasant psychology", "worker's psychology", etc. The Programme of the Communist Party of the Soviet Union, adopted at the 22nd Party Congress in 1961, mentions the importance of the struggle against "private-ownership psychology". In this connotation the term "psychology" implies a certain set of mind (interests, thinking, etc.) typical of a particular person or a social group.

I finished the conversation with my young friend with the words of the eminent Soviet psychologist Sergei Leonidovich Rubinstein: "Psychology which is something more than a ground for idle exercises of learned book-worms, psychology which is worth devoting one's life and all one's energies to cannot confine itself to an abstract study of the various 'functions' for their own sake, but must, through studying these functions, processes, etc., in the end lead to actual cognition of the real life of living people."

DOES FIDO HAVE CONSCIOUSNESS?

Out on a walk one day when, after climbing a mountain, we sat down for a rest, my companion watching indefatigable Fido, who was merrily barking while chasing his own tail, remarked with a smile:

"Wonder what Fido is 'thinking' now. And do dogs in general have consciousness?" Turning to me he added, "What does science have to say about it?"

"Well," I said, "I'll answer your question providing you first tell me if you have a stack."

"What stack?"

"Why, a stack. Do you have one or don't you?"

"But I don't understand your question," my young companion said perplexed. "If you will, please, explain what you mean by a stack, I may be able to tell you whether I have one or not."

I decided to stop joking and said:

"That's exactly why people could not tell whether or not animals had consciousness until they knew what they were talking about—the human consciousness with which they endowed animals or which they denied them."

We started a conversation, and this is what we talked about.

People long thought that human consciousness was an "immortal soul", a particle of the "divine spirit" which lived in the mortal body. As long as man had a soul in his body he was conscious; if the soul temporarily left the body, man was either in a swoon or asleep; if the soul left the body altogether, man died.

With this idea of human consciousness it was not difficult to answer the question about a soul in animals, although the answers of idealists varied. Some held that only man who was "created in the image of God" had a soul. Others believed that, since the soul was a particle of God, animals also had souls. In India many people still believe it a sin to kill even a mosquito, a bedbug or any other living being who, like man, allegedly also have souls. There were people who, contesting the religious views of consciousness, completely denied a soul, not only in animals, but also in man.

The essence of consciousness was scientifically explained by the originators of dialectical materialism. Frederick Engels showed that consciousness is a product of the human brain and that man himself is a product of nature. V. I. Lenin held that man's consciousness "is the highest product of specially organised matter"—the substance of the brain, and not of some one part or "centre" of the brain, but of all of its concerted, integrative activity.

Karl Marx emphasised another aspect of human consciousness, saying that it is a social product and will continue to be such as long as man exists. Consciousness and speech have developed together in the process of labour.

We know that social being determines social consciousness. The ideas of society, its convictions and political system derive from the material conditions of its life. However, man's consciousness not only reflects the objective world, but also creates and remakes it; if the surrounding condi-

tions fail to satisfy man's needs, man changes these conditions. And, if this be so, then consciousness—the highest form of reflection of objective reality—is inherent only in man. This Marxist view of consciousness has been named the "theory of reflection".

But consciousness did not come from nowhere; its origin and development have their history.

Fido has no consciousness. But he, as well as lower animals has a higher nervous activity about which the readers know from the preceding story. When we sometimes speak of consciousness in animals we mean the different properties of their higher nervous activity from which human consciousness has slowly developed.

However, we were "getting into deep water". My interlocutor now wanted to get, so to speak, under Fido's skin. I should think so! Wouldn't it be interesting to become for a short time, as in a fairy-tale, a dog, an ant or a swallow, in order, after becoming human again, to remember all one thought, perceived and felt while one was an animal. And I was asked:

"What is the animal's subjective world like?"

I answered this question in the words of three great men.

"In any case we shall never know *how* chemical rays appear to ants. Anyone who is distressed by this is simply beyond help," said Frederick Engels.

"We are unable to tell what passes through the mind of an animal," said Charles Darwin.

"We cannot have any authentic knowledge of the inner world of animals," said Ivan Petrovich Pavlov.

However, we must not let this distress us. The power of human consciousness allows man to gain an insight indirectly, through thinking, into the phenomena which cannot be cognised directly, through sensation. Psychology, as was already stated, studies the various aspects and manifestations of human consciousness—perception, attention, thinking, memory, emotions and the will. This science is already now able somewhat to lift the veil that still conceals the inner world of animals. And what man's inquisitive consciousness has not yet been able to cognise, it will certainly cognise in the future. At any rate, it is to be hoped that some day man will learn to look upon the world through the eyes of a snake and to feel it as does a pigeon. He will tune in an antenna on a dog's brain, will connect some sort of receiver to some kind of transmitter tuned in on his own brain and will, in a manner of speaking, become Fido. But it will require somebody else to press the buttons on the apparatus in order to bring him back to his human state.

FANTASY? YES, BUT WITHIN THE REALM OF POSSIBILITY!

I have not changed anything in the preceding story, but the end of it brought me a reprimand in a certain magazine for my "unfortunate fallacy" and I was told that what I had written was absolutely unfeasible. But is it?

Pavlov said: "In the terribly complex work of the cerebral hemispheres there is apparently the following principle: nothing of what was once formed is remade; it remains in the same form, and the new is merely superimposed." And this is precisely what makes my fantasy feasible.

Man does not remember all the feelings and perceptions of his childhood. But at the modern level of science, for example, by means of hypnoreproduction, which I shall describe below, he may be made to recall a good deal of it. Nobody can deny that some day man will learn to recall with much greater precision all that he has forgotten.

It follows that, if we were able to transform the human brain for some time (say, by resonance) into the brain of a dog, we would then be able, in principle, to restore the traces of what had gone on in this brain, i.e., make the brain which had become human again recall all that happened during its "canine" period (as well as in childhood).

It was no mere accident that in the foregoing quotations of Pavlov and Darwin the two scientists spoke in the present and not in the future tense: "are unable to tell" and "cannot have any authentic knowledge". But Engels was also justified in speaking in the future tense. Man's brain is not so far removed from that of the dog. But the common ancestors of man and the ant were only very simple multicellular animals with the simplest reticular nervous system. The structures of the nervous systems of man and the ant differ so much that there are no reasons to assume that it will be possible to model in man's brain the work of the ant's pharyngeal ring which serves as its brain.

LOST... CONSCIOUSNESS

While driving in a nail a girl badly hurt her finger by hitting it with the hammer.

A few minutes before that she had been "fully conscious", but now she suddenly "lost consciousness"—turned very pale, reeled and would have collapsed, if she were not caught in good time. She was in this condition for a minute or two without in any way reacting to the anxious words addressed to her. Then she took a long breath, opened her eyes and smiled confusedly.

The girl described her own condition as follows:

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"It hurt very much and made me a little sick; I felt dizzy, there was a ringing in my ears, everything appeared as though in a haze and then went dark before my eyes. What happened later I don't remember."

Fainting has served as a source of superstition since time immemorial. Primitive man also lost consciousness when he was hit on the head with a stone hatchet. People "saw" his soul leave his body through the mouth with his breath and then return as he recovered his breath. How could they help identifying the breath with the soul and consciousness?

A swoon—sudden and usually brief (for several minutes or even seconds) loss of consciousness—is caused by acute circulatory insufficiency of the brain. Man turns pale, the blood drains from the face and accumulates in the internal organs.

The brain is very sensitive about its blood supply. If the "portion" of blood is insufficient, the brain does not receive enough oxygen, and loss of consciousness may be the result. A long reflex breath decreases the oxygen deficiency in the brain and consciousness returns.

Insufficient blood supply to the brain may be due to various causes. In the afore-described case it was caused by pain. Sometimes a faint may be the result of a sudden redistribution of blood as, for example, when a person long in a recumbent position suddenly rises.

Faints clearly show that consciousness depends on proper functioning of the brain and the conditions under which it functions.

PETIT MAL

It also may be thus. A person is working, talking or writing. Suddenly he suffers a lapse of consciousness lasting a few (sometimes a score) seconds. The person does not fall, only stops or even continues to do something, at times something incongruous. Then he comes to without being aware of or remembering his brief unconsciousness. If he is writing when this happens he may leave a line or ringlets on the paper. This disease is called *petit mal* (French) which means a minor illness.

This disease has engendered many superstitions. It still gives rise to many of them. During the lapse of consciousness the patient may do a number of things (turn a light on or off) which he then ascribes to other people or to "mysterious forces."

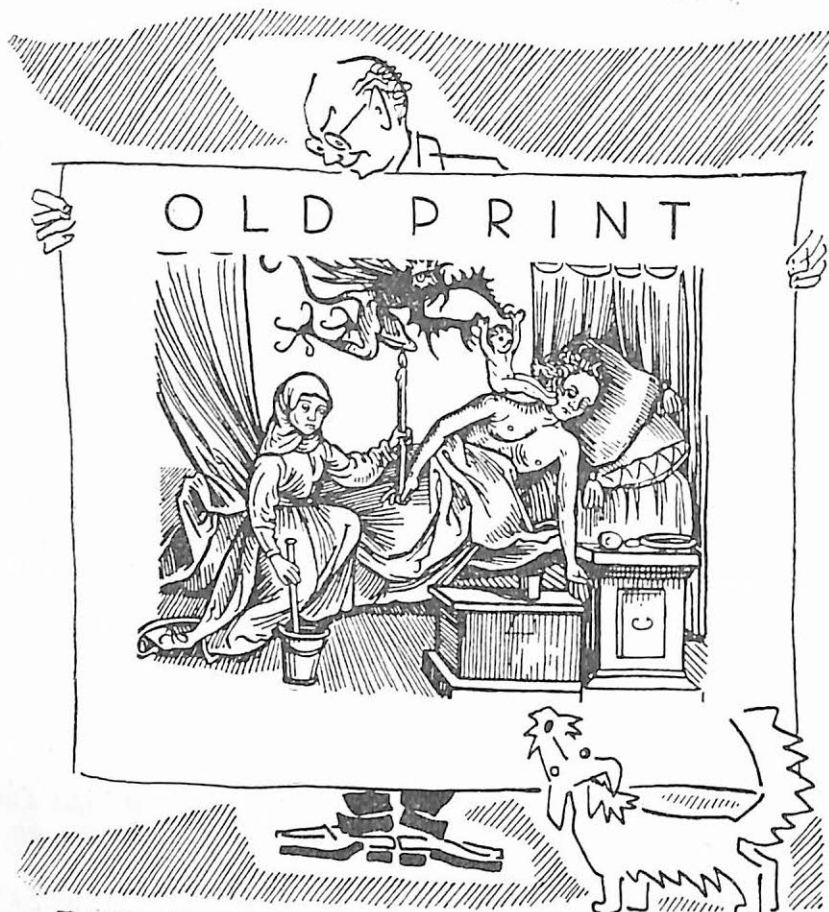
STORY TOLD BY ONE WHO "HAD RISEN FROM THE DEAD"

Death has always made man meditate upon its essence. It is precisely death that prompted man to create the myth of the immortal soul. Engels explains the birth of this myth as follows:



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THE SOUL LEAVING A PERSON AT THE MOMENT OF HIS DEATH

"Already at the very remote time when people, still ignorant of the structure of their bodies and unable to explain dreams, arrived at the idea that their thinking and sensations are not activities of their bodies, but of some special principle—a soul which lives in the body and leaves it at the moment of death—they had to ponder over the relation of this soul to the outside world. If the soul leaves the body at the time of death and continues to live, there is no reason for inventing some special death for it. Thus the idea of its immortality came into existence. . . ."

Reason always protested against the death of a person who but recently had been full of vim, vigour and vitality. All peoples have legends about persons rising from the dead with the aid of "water of life and death", magic potions or a "holy" word. We have now learned, with the aid of artificial circulation and respiration, to return man to life in the course of about one hour of clinical death.

Here is an excerpt from the case history of one of the many persons "raised from the dead" by the Soviet professor Vladimir Aleksandrovich Negovsky: "The injured died as the result of shock and acute hemorrhage at 2:41 p.m. of March 3, 1944. He was in a state of clinical death. Pulse—impalpable. Cardiac function—arrested. Respiration—absent. Pupils—dilated to the maximum. The first signs of returning consciousness appeared one hour after beginning of resuscitation. Patient's general condition at 11:00 p.m.—grave. The patient was asleep, but readily awakened when called. Answered questions. Asked for drink. Complained of total inability to see. The resuscitated patient recovered his vision on the following day."

And here is what the person "raised from the dead" had to say:

"I lost consciousness before I died and it returned at the end of the operation. All that time I seemed to be narcotised. I missed my own death."

RIDDLES OF SLEEP

When you go to sleep tonight try to remember how you fall asleep and to notice tomorrow morning how you become aware of your awakening.

Not all of you will apparently have equal success in this experiment. Many of you will fail to notice how you have fallen asleep and how you have awakened; on the other hand, those of you who are very sensitive will probably never fall asleep, waiting to see when it happens.

The following is a curious record of one such experiment.

"I asked my roommate not to sleep and to wake me up a few minutes after I fell asleep so that I might immediately jot down my impressions before I forgot them.

"How I fell asleep. I remember watching myself, hearing the ticking of the clock and the barking of dogs. I recalled yesterday's boat ride, and for a moment I thought I was in the boat, but it immediately dawned on me that I was in bed and that I had to watch myself falling asleep. Then my roommate began to shake me. I told him I wasn't asleep yet, but he said I had already snored and hadn't heard his calling me.

"How I woke up in the morning. My dog's barking was growing increasingly more distinct. I felt the sun's rays on my face, but did not open my eyes and continued dreaming that I was riding a train and had a dog in my compartment. Suddenly I became aware that I was in my

bed. I opened my eyes a little and immediately recalled that I had to write down how I awakened. But I did not care to drive my sleep away completely, and it occurred to me that I should like to sleep a little longer. Then I recalled that I had decided to train my will, so I got up and wrote everything down."

By repeating this experiment anyone may find out how on falling asleep and on awakening the state of consciousness gradually changes from clear to its total loss and vice versa. This change is particularly distinct in a person who is very sleepy, but whom something hinders from falling asleep. These intermediate states between sleep and waking make it possible to gain a better insight into man's consciousness.

For people who were unable to explain sleep this state served as grounds for all sorts of superstition. Among some peoples it was even taboo to awaken a sleeper because his soul might not be able to come back to him if it had flown too far away. It was also taboo to transfer a sleeper to another place because his soul might not find him when it returned.

The riddle of sleep was unravelled by the famous Russian physiologist Ivan Petrovich Pavlov (1849-1936). He discovered that sleep sets in when the highest part of the central nervous system (the cerebral cortex) and even the midbrain (mesencephalon) enter the state of inhibition. He very aptly called sleep "diffuse inhibition", saying that "internal inhibition and sleep are the same thing, the selfsame process". Sleep safeguards the brain cells against exhaustion.

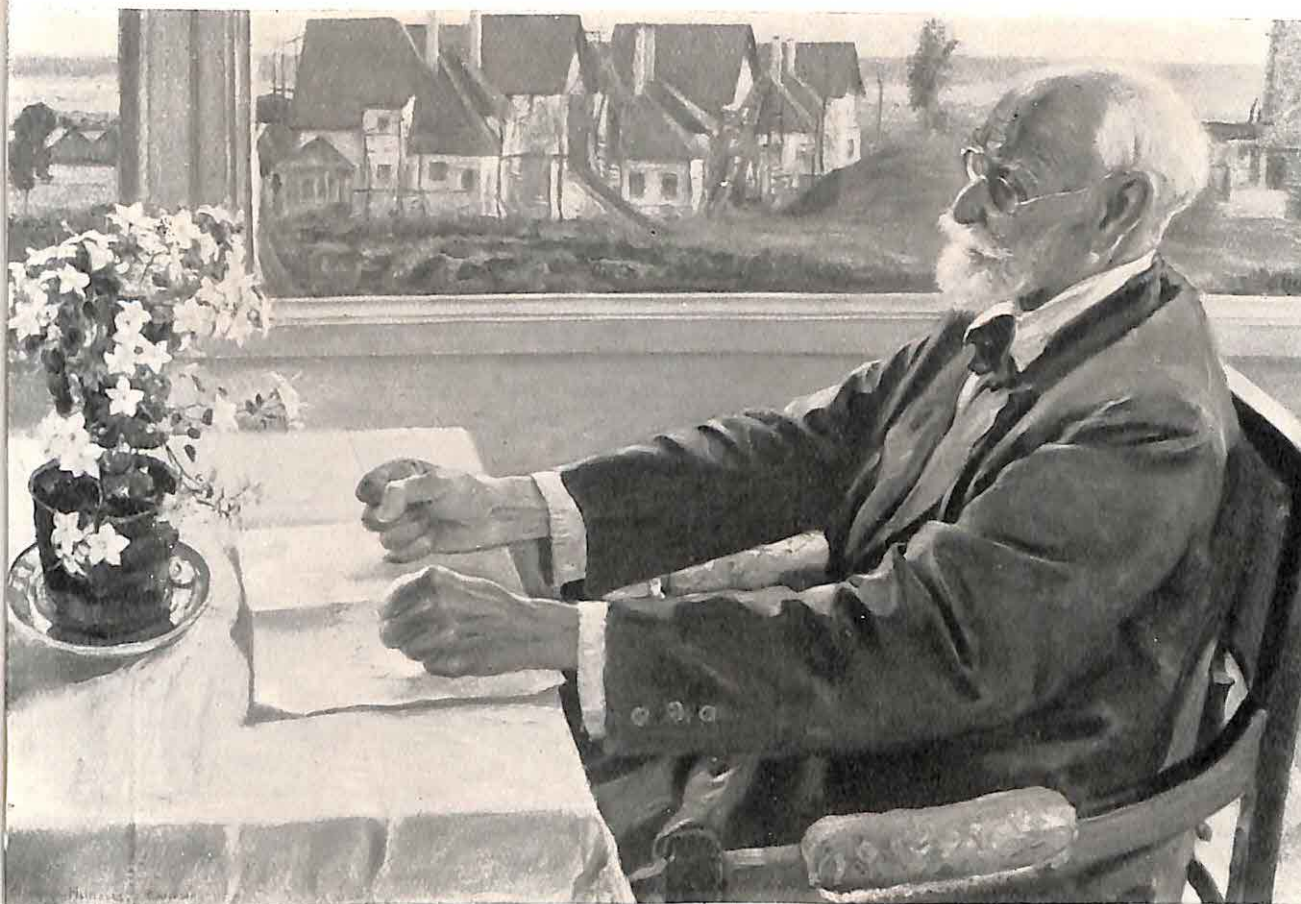
You will read about inhibition on p. 57.

When neurosurgeons learned to operate on the brain they almost decided that there was a special "centre of sleep". The reason for it was that operations on the brain are painless and may be performed without anesthesia, with the patient awake. But as soon as the surgeon's knife touches a certain accumulation of cells in the depth of the brain the patient falls asleep.

A cat with very fine electrodes implanted in the depth of her brain does not feel bad at all, but begins to yawn, rolls up into a ball and falls asleep as soon as a weak current is fed along these electrodes.

Subsequent investigations have shown, however, that here it is not a case of a "centre of sleep", but one of a disturbance in the complex interaction in the work of the cortex and the subcortex, this disturbance causing diffuse inhibition in the cells of the cerebral cortex.

Formerly physiologists believed the cause of sleep to be poisoning of the brain with hypnotoxins, special poisons appearing in the blood of tired man. But this view was found to be erroneous; this fallacy was convincingly demonstrated by the Soviet physiologist Pyotr Kuzmich Anokhin who observed the Siamese twins Ira and Galya. The girls had



I. P. PAVLOV



a common circulatory system and individual nervous systems. They slept at different times, which shows that it is not a matter of hypnotoxins circulating in the blood, but rather that the cause lies in the nervous system.

DIFFERENT PEOPLE—DIFFERENT DREAMS

Some people have such dreams that you could actually show them in the cinema. Such people wake up and remember all they dreamt, as though they really saw a film. Others don't dream at all and sleep like logs. Still others dream only if they had plenty of sleep beforehand. There are some people who, if they have had any excitement during the day, see in their dreams the things that excited them. Sometimes they dream of the same things, but their dreams appear in the form of symbols. Some people have the same dream time and again all through life.

There is a hypothesis that man dreams only during the last moments before awakening. But one may awaken and fall asleep again many times during the night.

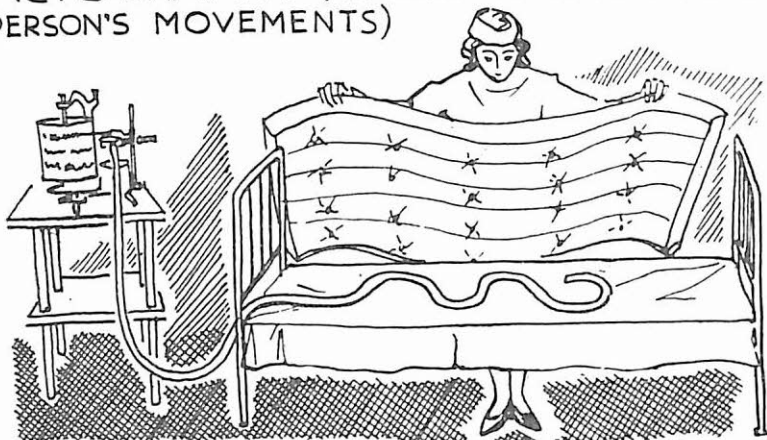
You may perform the following experiment which will help you to understand the essence of dreams. The experiment requires several people. Ask them to sit down comfortably, to close their eyes and imagine that they are riding a train, are hearing the rumble of wheels and are looking through the window at the trees and fields flashing past. Then ask them to continue sitting quietly with their eyes closed and to think of anything that may occur to them.

About five minutes later ask each one to tell you what he (or she) was thinking about and you will find that they all thought about different things far removed from the picture of the train you had conveyed to them by your words. In most of them the thoughts very probably strayed from one subject to another. This is so-called non-purposive thinking. If nearly all the cerebral cortex of the participants of this experiment were inhibited, the thoughts associated with the work of the various uninhibited parts of the cortex would take the form of dreams.

Dreams are peculiar states of the consciousness of a sleeping person characterised by more or less vivid images. They occur as the result of the work of various uninhibited parts of the cerebral cortex. That is why what we dream is based on impressions we have already had, these impressions now forming the most diverse and at times simply absurd or even fantastic connections. Ivan Mikhailovich Sechenov* very aptly said that dreams are often impossible combinations of possible impressions.

* I. M. Sechenov (1829-1905)—famous Russian naturalist, originator of the Russian school of physiology and founder of the natural-science trend in psychology.—Ed.

ACTOGRAPHY (RECORD OF A SLEEPING PERSON'S MOVEMENTS)



MAKES IT POSSIBLE TO ESTIMATE
THE DEPTH OF HIS SLEEP


ACTOGRAM OF DEEP SLEEP


ACTOGRAM OF LIGHT SLEEP

If the sleep is light, it means that a greater number of the nerve cells in the cerebral cortex are uninhibited. Sometimes inhibition is very strong and spreads over the entire cerebral cortex, in which case there are no uninhibited parts and the result is deep, sound sleep without dreams.

The depth of sleep may be determined by the method of actography. To do this, a curved rubber tube is placed on the bed under the mattress; one end of the tube is tied and the other is connected to a pneumatic capsule and an apparatus which records all of the sleeper's movements. The lighter the sleep, the greater the motor activity of the sleeper.

Not all dreams are remembered.

Once I travelled by train in the daytime. A man was fast asleep on the upper berth in my compartment. Suddenly he began to speak and made a long and, I must admit, fine speech in defence of an accused person. He finished his speech and fell fast asleep again. When he awakened I asked him what he had dreamt. He told me he had had no dreams for he had slept like a log.

He turned out to be a lawyer on his way to a court trial.

Not only man dreams. Dogs, too, have some sort of their own dreams and sometimes growl, whimper or yelp in sleep.

My dog Dick not only whimpers in sleep, but even moves his legs, as if he were running. When I awaken him he seems as though he were in suspended animation, but then he comes to. Just like a half-awake human being.

SENTRY POST

During the Great Patriotic War I chanced to observe a physician who after several sleepless nights finally managed to get some sleep. Soon a number of wounded arrived and had to be immediately treated, but the physician just could not be awakened. We nudged him and sprinkled his face with water, but he mumbled, shook his head and fell asleep again.

Then I asked everybody to keep quiet and said to the physician softly but very distinctly:

"Doctor, casualties have arrived and need your aid." The physician woke up at once.

This can be explained as follows: Those who tried to wake him up before, exerted action on the deeply inhibited parts of his brain, whereas I called upon his "sentry post", as Pavlov named the uninhibited or slightly inhibited part of the cerebral cortex which is awake even during sound sleep. Through this "sentry post" man maintains connection with the outside world.

The stimulation reaching such "sentry posts" in the brain (see the illustration on p. 63) may also disinhibit other, formerly deeply inhibited parts of the cerebral cortex. For example, a mother who has fallen asleep at the bedside of her sick child will not awaken even when loudly called by anybody else, but will immediately shake off her sleep in response to her child's faintest moan. A miller sleeps fast during a thunderstorm, but awakens the moment his grindstones stop.

The cells of the "sentry post" are not completely inhibited and are in the so-called "paradoxical phase" in which they are more sensitive to weak stimuli than to strong ones. That is precisely why I spoke the words, which awakened the physician softly, but very distinctly.

Animals also have "sentry posts" owing to which bats, for example, sleep, heads hanging down, and do not fall; horses, as is well known, sleep standing, and a sleeping octopus always has one leg awake, "on duty".

DAYS IN SECONDS

A certain well-known playwright fell asleep from fatigue as soon as the curtain rose at the première of one of his plays. The interesting part of it is that in his sleep he saw the entire play, from beginning to end, and

was very much gratified with the reception the public accorded his play. Then the curtain fell to a thunder of applause, the playwright woke up and heard the first words of his play spoken from the stage. The playwright had slept but a few seconds.

The duration of the events occurring in a dream in no way corresponds to the duration of the sleep. Very "long" dreams may last but a few seconds.

The French historian Maury, who lived in the last century, once had a dream which, as he admitted, surprised him so much that he made a special study of this question and wrote a book entitled *Sleep and Dreams*. Here is how Maury himself described this dream:

"I was sick in bed, and my mother sat at my bedside. I dreamt that we were living at the time of the Great French Revolution. I witnessed various exciting scenes and was brought to a session of the Revolutionary Tribunal where I saw Robespierre, Marat and other well-known revolutionary leaders. I argued with them and, after a number of adventures, finally heard the death sentence pronounced upon me. Then, from the top of the fateful cart, I saw a crowd; I mounted the scaffold and was tied by the executioner; the blade of the guillotine fell, and I felt my head separating from my neck. At that moment I woke up terror-stricken and saw that one of the cross-pieces supporting the bedcurtains had fallen and had hit me on the neck. My mother assured me that I awakened immediately after the fall of the cross-piece."

PROPHETIC DREAMS

"Look what an interesting book. I got it from an old, old woman, our office-cleaner." The girl handed me a little soiled pamphlet.

On the title-page there was a picture of a sleeping person and by his side stood death with a scythe and ringing a bell. The pamphlet was entitled *Explanation of Dreams by the Famous Old Man Martin Zadeka*. It was published in 1914.

"At one time," I said, "such dream-books were very popular. Even Pushkin mentioned this particular book in *Yevgeni Onegin*.

*Her dream—she cannot comprehend it—
Perturbs Tatyana; and what fate
By that dread vision is portended
She fain would now investigate.
She finds, in the Contents, that there is
A perfect alphabetic series:
Bear—bridge—fir—gloom—and hedgehog; next*

*Raven-storm-snowstorm-wood . . . the text
Goes on. . . But Martin's book is failing
To solve the doubts that vex her still. . .*

The girl turned over a few pages and read: "To see and eat water-melons in one's dream is a sign of discontent and of a sad adventure. To see Indian hens is a sign of a promotion to a higher rank or of inheriting a large fortune."

"Nonsense," the girl said with a laugh.

"It makes no sense at all," I agreed. "Although, you know, the content of dreams often gives neuropsychiatrists valuable material. For example, not a single physician will sanction the flight of a flyer who after surviving or even only witnessing a crash continuously sees crashes in his dreams. The physician will see to it that the flyer takes a good rest, gets a little recreation or even takes some treatment. These dreams are symptoms of a neurosis.

An analysis of the dreams often helps the physician to understand the cause of the nervous disease, i.e., the hard and protracted emotional experience that caused the disease.

There has been a case of a person who dreamt that he was painfully bitten in the leg by a dog. He told his friends and relatives about it. After a while the site of the "bite" began to hurt and a malignant tumour developed. This fact was confirmed scientifically.

Such cases produce so strong an impression that the fairy-tales, legends and superstitions of every people in the world contain prophetic dreams, i.e., dreams that foretell the future.

These dreams are quite easy to explain. An incipient disease often fails to be noticed in the daytime because the cerebral cortex is exposed to a large number of stimuli of different strength. But at night, when there are no external stimuli or their number is at least considerably reduced, these pain sensations reach consciousness and assume the form of situational dreams.

In this connection the Soviet neuropathologist Mikhail Ivanovich Astvatsaturov wrote: "If disturbing dreams containing an element of fear of death are combined with a sudden awakening, it may arouse suspicion of a heart disease at a time when there are no other subjective indications of such disease."

There have been many cases where an everyday or a scientific problem was solved not in the daytime, but at night, in a dream. For example, the German chemist Kekule saw the structural formula of benzol in his dream. A dream helped the Russian scientist Dmitry Ivanovich Mendeleyev to develop the famous periodic system. In his sleep the composer Tartini heard someone play a sonata. Voltaire dreamt a new version of his *La Henriade*.

Homer said that "the gods used dreams to communicate their will to man". In ancient Sparta special magistrates—ephors—went to sleep in temples so that correct decisions of difficult state questions might come to them in their sleep.

There is a popular saying: "Sleep on it". This is true not only because of what was said above, but also because in the evening the nervous processes in the tired brain are inert.

It is interesting that the deeper the sleep, the earlier the period from which the associations and interpretation of impressions come to the sleeper. Peasants have a popular belief that, if their long deceased parents visit them in their dream, they will have a spell of bad weather. This may not be devoid of logic because before inclement weather people are very sleepy, their sleepiness being characterised by images from the remote past visiting them in their dreams. That is how the famous Russian physiologist Nikolai Yevgenyevich Vedensky explained the mechanism of one more prophetic dream.

INTUITION—DAUGHTER OF INFORMATION

When the fishermen vacationing in our holiday-home assembled at supper everybody looked enviously at the fishpound of one of them, wondering how he was always able to find places teeming with fish.

"I have an intuition and always feel where the fish will bite and where it is a mere waste of time," the lucky man explained.

The expression "intuition tells me that..." can be heard quite often. At the same time the term "intuition" is interpreted variously. Bourgeois philosophers and idealist psychologists imply by intuition some mysterious, extrasensual and subconscious cognition of the world. We, materialists, cannot accept that.

Properly understood intuition means a generalisation in the consciousness of a number of petty facts which are difficult to perceive and take into account. Such generalisation is possible only on the basis of extensive experience in the given field. Consequently, information of such events is still the mother of intuition. True, this information is not always synthesised consciously.

For example, by means of intuition an experienced land tiller will predict the future crop by a number of barely noticeable signs and an old physician will immediately establish a correct diagnosis. Similarly, the above-mentioned fisherman usually found the best fishing place. However, intuition cannot take the place of precise cognition based on a conscious analysis of specially obtained facts.

"PUNCH, BROTHERS, PUNCH"

"Will the reader please to cast his eye over the following verses, and see if he can discover anything harmful in them?"

*Conductor, when you receive a fare,
Punch in the presence of the passenjare
A blue trip slip for an eight-cent fare,
A buff trip slip for a six-cent fare
A pink trip slip for a three-cent fare,
Punch in the presence of the passenjare!*

Chorus:

*Punch, brothers! punch with care!
Punch in the presence of the passenjare!*

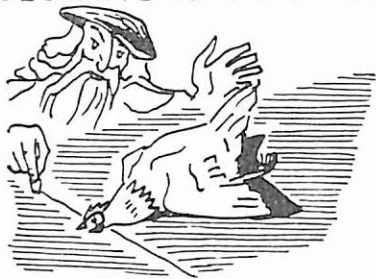
"I came across these jingling rhymes in a newspaper, a little while ago, and read them a couple of times. They took instant and entire possession of me. All through breakfast they went waltzing through my brain; and when, at last, I rolled up my napkin, I could not tell whether I had eaten anything or not. . . . I took up my pen, but all . . . I could get it to say, was 'Punch in the presence of the passenjare'. . . . The day's work was ruined—I could see that plainly enough. I gave up and drifted down town, and presently discovered that my feet were keeping time to that relentless jingle. When I could stand it no longer I altered my step. But it did no good; those rhymes accommodated themselves to the new step and went on harassing me just as before."

That is how Mark Twain begins his highly entertaining story.

A tired person often develops so-called perseveration—a persistent repetition of some phrase, usually rhymes, a melody and sometimes an image. The physiologic mechanism of perseveration is inertness of the excitatory process in some focus of the cerebral cortex, a so-called "inert focus of excitation". Perseverations may also occur in a healthy person. An oxygen deficiency, for example, in a high altitude flight, in the mountains or in a poorly ventilated mine, is conducive to development of perseveration. Sometimes, however, an obsessive idea becomes a symptom of a mental disease—neurosis.

Closely related in their mechanism to obsessive ideas are "pet ideas". The difference between the former and the latter is that man strives to get rid of his obsessive ideas, but fights, often contrary to logic, stubbornly and unreasonably, for his pet ideas. In such cases it is usually said, "He took it into his head and won't hear of anything else."

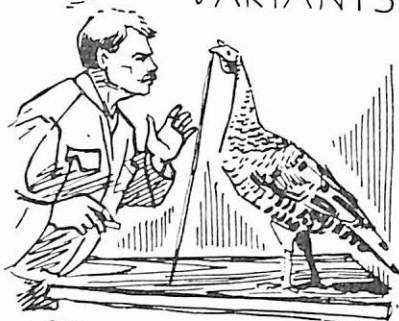
THE "WONDERFUL EXPERIMENT" DESCRIBED IN 1646



AND ITS OTHER



VARIANTS



EXPERIMENTUM MIRABILE

In his book *The Great Art of Light and Darkness* published in 1646 Athanasius Kircher described an experiment which he called marvellous (*Experimentum mirabile*). This experiment can be performed by anybody.

If you tie the legs of a chicken, put the chicken on a table and draw with chalk a line from each of the chicken's eyes so that the two lines form one straight line running through both eyes, the chicken will remain immobile even if you untie its legs.

Kircher thought that it was all a matter of the lines. But the same results can be produced without drawing any lines by merely quickly turning the fowl over on its back. The same experiment can be performed with pigeons, guinea-pigs, rabbits and frogs. It looks particularly effective with the Caucasian agama (a large lizard) which, as though made of wax, assumes any posture imparted to it and keeps it for a long time.

These are all manifestations of so-called catalepsy which is sometimes referred to as hypnosis of animals and is often used in the circus. The



well-known animal trainer Vladimir Leonidovich Durov often demonstrated the trick with a turkey shown in the illustration.

Human beings may also be in a state of catalepsy. A hypnotised person who is in a state of catalepsy may be placed on two chairs—back of the head on one and heels on the other—and he will lie in this position as though made of wood. "This is one of the self-protective reflexes of an inhibitory character," said Pavlov, explaining Kircher's experiment and all analogous states in animals and man. He held that in catalepsy the cerebral cortex is inhibited and even switched off, but the activity of the motor centres is not depressed.

This is one more peculiar state of higher nervous activity similarly manifested in man and animals.

ANIMAL MAGNETISM

In 1774 Franz Mesmer, a Viennese physician, submitted to the Paris Academy of Sciences a thesis in which he tried to substantiate his theory of animal magnetism.

He attempted to prove that patients could be treated not only by applying a magnet to the body, but also by animal magnetism—fluids, a certain "psychic current" allegedly emitted by some people who are capable of condensing the magnetism of the planets in themselves. Under the influence of these fluids man falls asleep and is cured.

In 1784 a special commission which included the famous scientists Antoine Lavoisier and Benjamin Franklin, as well as the French physician Guillotin (the one who eight years later urged the use of a machine—named after him—for beheading persons), stated that it had unanimously arrived at the following conclusions concerning the existence and benefit of magnetism: nothing proves the existence of an animal magnetic fluid, consequently, this non-existent substance cannot be of any benefit; the morbid consequences observed during public treatment are due to contact, excited imagination and mechanical imitation which forces us unwittingly to repeat that which surprises us. . . . Any public treatment with magnetism cannot but prove harmful.

However, the commission could not disprove the fact that one person may be artificially put to sleep by another. Mesmer's ideas therefore became very popular and even came down to our time.

The "magnetic sleep" was investigated by the Scottish physician James Braid who in 1843 published a book entitled *Neurohypnology* in which he categorically denied the theory of fluids. The induction of sleep in man described by Mesmer he explained correctly by fatigue of the eyes. This fatigue sets in, for example, if a person looks at a shiny object for a long

time. Braid named this state hypnosis, using the Greek word *hypnos* which means sleep.

After Braid, too, many attempts were made to explain the mysterious phenomena of hypnosis which was used by ancient priests for religious purposes. The most mysterious part of it was the connection between the person who has fallen asleep and the one who had put him to sleep, i.e., the so-called rapport which enabled the physician to issue instructions and orders (carried out with precision by the patient) and even to suggest analgesia (insensibility to pain). Owing to the rapport the person put asleep talks, answers questions, walks, etc. After awakening the hypnotised person develops amnesia, i.e., he forgets all he did in the state of hypnosis.

A correct and all-round explanation of these phenomena was given only by the Russian physiologist Pavlov in his theory of higher nervous activity.

UNRAVELLED RIDDLE

Pavlov's theory completely deprived hypnosis of its former mysteriousness. It established the community of hypnosis with many long-known phenomena.

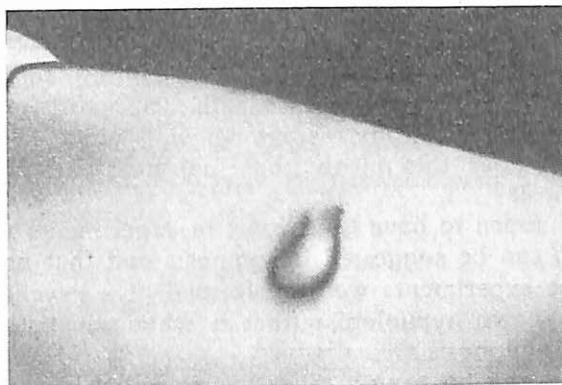
Is there anyone among us who did not want to fall asleep at a boring lecture, especially if delivered in a monotonous voice? A mother lulls her child to sleep with a melodious, but infallibly monotonous lullaby. By the same method a physician induces sleep in man with the aid of hypnosis.

At home, in the habitual surroundings and at the habitual time we fall asleep faster than in different and new surroundings. The conditioned reflex mechanisms (we shall discuss them below) which determine this also play a very important part in hypnosis. The physician reminds the subject in so many words of the state he usually experiences when falling asleep, and this also induces sleep. In group hypnotic sessions the sight of one person who has fallen asleep is conducive to induction of sleep in the others.

But there is a difference between usual sleep and hypnosis. Pavlov explained this difference as follows: "If the inhibition spreading over the cerebral cortex meets no obstacles, you will get ordinary sleep. If only part of the cerebral cortex is inhibited, you will have partial sleep—a state usually called hypnosis."

The physician's voice leaves in the cerebral cortex of the person falling asleep a waking focus—"sentry post" (see illustration on p. 63) whose nature we have already discussed. If anyone else, other than the physician who put the subject to sleep, says anything to the subject, the latter

THIS SECOND DEGREE BURN WAS PRODUCED BY A WORD



does not hear him; the same thing happens in usual deep sleep. But the hypnotiser's voice reaches the "centry post", and the subject therefore hears it.

The word received by the "sentry post" becomes a suggestion capable of disinhibiting certain parts of the cerebral cortex or of keeping them inhibited after awakening. That is why, if the physician who put the patient to sleep says, "Wake up" to him, he wakes up. Yet nobody else can wake him up with these words.

If nothing is suggested to the hypnotised person, he will simply sleep. This is a so-called "hypnotic rest" which possesses a curative force. I saw a person put to sleep in a state of alcoholic intoxication. After a brief "hypnotic rest" he woke up absolutely sober.

One day, while on duty in the hospital, I put one of my patients to sleep for the purpose of giving him a hypnotic rest and decided not to awaken him. The patient slept till the following morning and woke up spontaneously well rested and cheerful as after usual, good, sound sleep.

NON-FULFILLED SUGGESTION

Hypnosis is suggested sleep and it is used for therapeutic purposes. It is also employed in scientific research in order to gain a deeper insight into certain mental phenomena.

A coin taken out of a pocket was placed on a person's arm with the words:

"The coin is red hot. You have sustained a severe burn."

To be sure, the arm developed a second degree burn.

This experiment throws light upon the well-known case of the bleeding ulcers on arms and legs ("the wounds of crucified Christ") of the French religious fanatic Louise Lateau. It also enables us to understand how hard emotional experiences may cause grey hair and baldness, and how a careless word may even cause death. The word may be used to cure man, of which I shall tell my readers below.

But does this mean that anything at all may be suggested in hypnosis?

I happen to have taken part in experiments which prove that not everything can be suggested in hypnosis and that not everybody is suggestible. These experiments were performed at a psychoneurological institute by a well-known hypnotist (that is what scientists investigating the phenomena of hypnosis are called).

A girl who rapidly and deeply fell asleep under hypnosis and always carried out various complex assignments was told:

"As you see, N. has fallen asleep; he has a wallet with money in his pocket. Take the money, he won't know about it, anyway."

This time the hypnotised girl refused to obey. After the suggestion ending with the words—"I order you to do it"—was repeated she failed to obey again and woke up, although she had been fast asleep.

Another hypnotised girl was asked to kiss a stranger (man) who entered the room. The girl reacted with a nervous fit which was rapidly arrested by the suggestion: "You got me wrong. You have forgotten this suggestion and may sleep calmly."

These two cases attest that, if a person's moral qualities, his conscience in particular, are well developed, they prove superior to suggestion in hypnosis.

FORCE OF A GAZE

One of my acquaintances said that by looking at the back of a person's head he could make the person turn around.

"Try it," I suggested.

Unnoticeably placing himself behind a friend he fixed his gaze on the back of her head. To be sure, the woman soon turned around saying:

"What are you puffing there for?"

The exultation on the "hypnotiser's" physiognomy immediately faded. It was a convincing refutation of the very popular but entirely ungrounded faith in the "force of a gaze".

Count the number of cases in which the person at the back of whose head you gaze will turn around and then count the number of other people who will not turn around during the same period of time. If the number of observations is sufficiently large, there will be no difference, providing, of course, you do not start breathing into the backs of the people's heads, like my above-mentioned acquaintance, or do not tread on their heels, or do not in any other way attract the attention of your subjects by producing in them what Pavlov called a "what is it?" reflex.

The human eye has already been adequately enough studied to warrant the asseveration that it does not emit anything.

HOW OTHER PEOPLE'S THOUGHTS ARE READ

The first variant of this story was different, but my young friend Gera, whom I asked to read the manuscript, said:

"No, things are not so simple as you describe them here. I watched Mikhail Kuni and Wolf Messing read other people's thoughts on the stage and I was amazed."

"Suppose you tell me about it," I said, and here is what he told me.

"They call for volunteers from the public, ask these people to write down what they want them to do and then, holding these people by the hand, carry out their assignments. I prepared my assignment beforehand. The assignment read: 'Go to the girl sitting in seat number so and so, row number so and so (one of my acquaintances), take a safety pin from her handbag, then find a man in seat number so and so, row number so and so (also one of my acquaintances), take a book, namely, *Gulliver's Travels* from his brief-case (in which there were several books), open it on page 86, punch a hole with the pin in the tenth letter on the 14th line, and return the pin to the girl.'

"The assignment was submitted to the jury. Messing took my hand and said: 'Don't think of anything, but what I have to do. Think hard,' after which he kept repeating, 'Think; think better.' He went and did all I had written down in my assignment. True, he made a number of mistakes, but quickly corrected himself. How could he do it if he did not read my thoughts?"

"Before we go on with our discussion let's do a little experiment," I said. "Take that watch and chain, close your eyes and 'think hard' that the watch is swinging towards you and away from you, or from left to right, or in circles, clockwise or counterclockwise. Think whatever you want, and I will read your thoughts."

Gera took the watch and closed his eyes. His face expressed concentration. I, for my part, kept repeating:

"Think better; think of how the watch is swinging."

About a minute elapsed, and I said confidently:

"You thought: 'In clockwise circles.'"

Gera opened his eyes and saw that the watch was really swinging in clockwise circles. The thing was that he was involuntarily moving his arm in the direction of which he was thinking, imagining how the watch was swinging.

Such movements are called ideomotor movements. This phenomenon was discovered in England in 1850, and soon many people were swinging buttons and rings suspended from the fingers by strings; this device was called an odometer. Of course, seekers of the new mysterious "odometric force" immediately appeared, and there were some who ascribed this force to animal magnetism.

Sechenov made a special study of the phenomenon of ideomotoricity; Pavlov wrote: "It has long been observed and scientifically demonstrated that, when one thinks of a certain movement (i.e., has a kinesthetic idea of this movement), one involuntarily, unwittingly performs it."

"It was not Messing who led you first to one person and then to the other, but you who led him," I said to my young friend. "To put it in scientific language, you were the inductor and he was the percipient."

When the percipient makes a correct movement, the inductor does not resist; when the movement is incorrect, the percipient feels the resistance of the inductor's hand. That is why both Messing and Kuni constantly make searching, scouring movements.

Any percipient can carry out only the assignments which break up even if into very many correct or incorrect separate movements. But neither Messing, nor Kuni, nor anybody else can carry out such an assignment as "Write the figure '5' ", or "Say such and such a word".

With good training anybody will be able in some measure to "read other people's thoughts", i.e., to become a percipient. But some people, like Mikhail Kuni and Wolf Messing, are endowed with the special ability of catching very precisely and unerringly the ideomotor movements of a man's hand. There is nothing mysterious about this. For example, Brown, an American, began to "read other people's thoughts" publicly as far back as 1874. His performances were later repeated by many others. With good training this ability may in some measure be developed by anybody.

In conclusion it must be said that it is wrong to call such sessions *experiments*, as it is done in advertisements. An experiment is a method of cognising the phenomenon being studied, whereas not a single variety actor wants his spectators to learn the truth about his tricks. I, personally,

had an occasion to conduct an experiment on Messing himself, which incidentally, greatly displeased him. But have patience, my Dear Readers, I shall yet come back to this episode.

VISIT FROM THE BEYOND

"...The empirical contempt for dialectics is punished by some of the most sober empiricists being led into the most barren of all superstitions into modern spiritualism," wrote Engels. He shattered the mystic faith in life beyond the grave and the possibility of communicating with the spirit of the dead, and ridiculed the "epidemic" of table-spinning that affected numerous people in Europe and America at the end of last century and at the beginning of ours. This popular fad also clouded the minds of some very prominent scientists—the physicist William Crookes, the chemist Aleksander Mikhailovich Butlerov, the biologist Alfred Wallace, and many others.

The history of spiritism began in 1848 when a man named Fox in the City of Rochester (U.S.A.) announced that he and his family spoke to souls of the dead. He, his wife and three daughters sat at a round table, placed their fingers on it, their arms extended and suspended in the air, and . . . the table began to tap out answers to their questions. It soon turned out that spirits spoke not only to Fox, not only in the U.S.A., and not only by means of a table. A saucer seemed to do just as well; it was also touched by the tips of the fingers and it moved upon a sheet of paper on which the alphabet was inscribed.

There were some people with whom the spirits were particularly willing to "communicate". These people were called mediums. The "spirits" of various people—celebrities, relatives, friends—came from the beyond. But the spiritists most frequently intruded upon the "spirit" of Napoleon or Alexander the Great, for everybody wanted to have a chat with great men.

It was impolite to find fault with spirits who were not even supposed to know anything about grammar. Whatever word the saucer or table "uttered" it was always found to convey a "profound meaning".

In 1875 the Physics Society of the St. Petersburg University organised on Mendeleyev's initiative a special "Commission for Investigating Mediumistic Phenomena". In addition to Mendeleyev, the commission included 11 other scientists. After numerous sittings the commission arrived at the unanimous conclusion "based on the aggregate of what its members had studied and seen" that "spiritualistic phenomena are the result of unconscious movements or conscious deception, and spiritism is a superstition".

Thus ideomotoricity explains not only the "reading of other people's thoughts", but also the phenomena of spiritism. Many cases of swindling during spiritualistic sessions were exposed in America at the beginning of the 20th century by the famous physicist Robert Wood who made ingenious use of ultraviolet photography. Lev Nikolayevich Tolstoi sharply ridiculed the spiritists in his play *Fruits of Enlightenment*.

But spiritism has not yet been dumped on the scrap heap of history. For example, in 1959 the football players of the British Gloucester City Club "called on" the souls of their famous colleagues and discussed playing tactics and training methods with them hoping that this would help to promote the team to a higher league.

AN INCIDENT WITH LOMONOSOV

The preface to the first academic edition of Mikhail Vasilyevich Lomonosov's works (1865) contains a story written by Academician Shtolin, Lomonosov's friend; the story had been told to the Academician by Lomonosov himself.

On his way back home (from Germany—*K.P.*) he once dreamt that his father had suffered shipwreck and had been thrown on an uninhabited island in the Arctic Ocean; it was the same island to which he (in his youth) and his father had once been driven to by storm. The dream rooted itself in his mind. His first impulse upon arrival in St. Petersburg was to inquire from inhabitants of Arkhangelsk and Kholmogory about his father. He found his brother who told him that their father had gone fishing as usual with the break-up of the ice that same year, that it was four months since he had gone and that neither he nor any member of his fishing crew had as yet returned. The afore-mentioned dream and his brother's words filled his heart with great anxiety. He made up his mind to ask for leave in order that he might go and look for his father on the island of which he had dreamt and to bury him with all honours due do him, should he really find his body there. But circumstances prevented him from carrying out his intentions. He had to send his brother to Kholmogory, paying his travelling expenses and giving him a letter to the local fishermen, in which letter he described the island precisely and in detail, beseeched them to visit the island on their first fishing trip, to search it high and low, and, if they found his father's body, to bury it there. Those people did not refuse his request and in the same autumn really found the body of Vasily Lomonosov precisely on the uninhabited island where they buried him and placed a big stone on his grave. Of all this M. Lomonosov was notified in winter.

Quite a few such cases have been recorded by authoritative people. Among them I can mention the critic Vladimir Vasilyevich Stasov, the chemist Butlerov, the psychiatrist Vladimir Mikhailovich Bekhterev, the ophthalmologist Vladimir Petrovich Filatov, Mark Twain, Upton Sinclair, and others. Since such cases had not been studied they often led to superstitions and mysticism, to a faith in the possibility of "anticipating the future".

Many people still fail to be persuaded by descriptions of such phenomena. Small wonder. Pavlov very sagely said: "We must not merely describe phenomena, but must reveal the laws of their development. Descriptions cannot alone make a science."

But such cases do not vouch for the authenticity of these phenomena. Small wonder, for there are more than the two explanations which always occur to the mind—fraud or telepathy ("since Lomonosov was no impostor, this must have been telepathy"). This case, like many similar cases, may be the result of illusions of the memory, which distort recollections, especially when related by other people.

MENTAL TELEPATHY

A bracelet is put on a person's forearm, wires running from the bracelet to a mechanical hand. The person mentally clenches his fist, and the mechanical hand reproduces this movement; the person mentally opens his hand, and the fingers of the mechanical hand extend. Such a "bioelectric manipulator" can be seen in the pavilion of the U.S.S.R. Academy of Sciences at the Exhibition of National Economic Achievement.

But, if thought can make a mechanism work by transmitting commands through wires, can it possibly also be transmitted from man to man by telepathy?

Before answering this question which is of interest to many people, I must remind the readers that thought is transmitted only through a material medium without which it does not even exist. I think and speak, the vibrations of the air bring my words to the listener, and the words become his thoughts. I write my thoughts down, and you will read them. But man's thought is a product of the work of his brain and is connected with bioelectric phenomena in the brain and other parts of the organism. It is precisely the action potentials arising in the muscles which flex the fingers into a fist that, received and amplified by appropriate apparatus, double the fingers of the mechanical hand when man thinks of it.

Academicians Vladimir Mikhailovich Bekhterev (psychiatrist) and Pyotr Petrovich Lazarev (biophysicist) admitted that under some special conditions still unknown to science the electric power of the brain of one person may act over a distance upon the brain of another person. If this brain is appropriately "tuned up", it is possible to produce "resonant" bioelectric phenomena and, as their product, corresponding thoughts, ideas, in it.

Perhaps, instead of physical phenomena inherent in inanimate nature and quite well known, we should search for new physical phenomena inherent only in animate nature.

A good deal is being written of late in many countries concerning the experiments conducted in America in 1959 with thought allegedly transmitted to a "human receiver" in a submarine 2,000 kilometres away and at a depth of several hundred metres. No radio communication with the submarine was possible since, as is well known, even a much thinner layer of water (several centimetres) does not let radio waves pass.

In these experiments the "human transmitter" was on shore. Twice a day during the 16 days of the experiments this man sat down at the appointed time at the apparatus in which there were 1,000 cards. Each card had one of the following 5 figures—three wavy lines, a circle, a cross, a rectangle and an asterisk—on it. The apparatus mixing the cards threw out several cards at random one every minute. The "human transmitter" looked intently at them. At the same appointed time the "human receiver" in the submarine drew the first of the five figures that came to his mind. Then the figures at which the "transmitter" had looked and the drawings made by the "receiver" were compared. According to mathematical calculations, the accidental coincidences may equal 20 per cent. In this case they were more than 70 per cent. It should be noted that in the U.S.A. these experiments were not given official confirmation. But such experiments are not new. At the beginning of the century they were performed by the famous French psychiatrist Charles Richet. In 1930 the well-known American writer Upton Sinclair described in his book *Mental Radio* similar experiments he had performed with his wife.

In 1923, I, then a student of biology, took part in the experiments conducted by my father—Konstantin Ivanovich Platonov—psychotherapist and hypnologist. Under the impression of a certain book I asked my father to try mentally to put to sleep one of his patients who fell rapidly and deeply asleep. For some time Father tried to dismiss the matter with a joke and even got angry, but one day he did it, and ... the patient fell asleep. He woke up the patient also mentally. Later we repeated this experiment many times and in various forms. In 1924 father demonstrated such

experiments at the Congress of Neuropathologists and Psychiatrists in Leningrad.

In 1932-37 the well-known physiologist Leonid Leonidovich Vasilyev proved by a number of experiments that mental induction of sleep and awakening from hypnosis is at times possible even when the hypnologist and the subjects are divided by a screen which does not let radio waves pass.

A special laboratory for studying phenomena of telepathy (this Greek word means awareness at a distance) was organised under Vasilyev's supervision at the Institute of Physiology of Leningrad University. Sometimes these phenomena are called *parapsychology* (the Greek prefix *para* means "beside", "near") thereby emphasising that these phenomena are still outside the field of traditional psychology.

In 1962, Leningrad University published Vasilyev's book *Experimental Studies of Mental Suggestion*. In a word, this question is now an object of strict scientific investigation.

Vasilyev believes that the ability to exert an influence over a distance is not improved in the course of development of animals and man, but is, on the contrary, a very rare manifestation, an accidental vestige of the distant past, something like the vermiform appendix or the hair on the body. In biology this is referred to as a "rudiment".

Many scientists doubt the reliability of such experiments. But even those who, like I, saw them with their own eyes believe that such influence exerted at a distance is an extremely rare occurrence which requires a special "tuning of the brain". At the present stage of its development the science of psychology can as yet neither prove nor disprove that the facts described by different peoples at various times—a mother becoming aware of her child's death or one of the twins becoming aware of the death of the other twin at a distance—can be thus explained.

However, we have every reason to aver that in our days man can neither transmit his thoughts precisely to people he should like to, nor read the thoughts of those he should like to read. Most cases usually regarded as telepathy must be interpreted differently, i.e., the same as, for example, the afore-described sessions of Wolf Messing and Mikhail Kuni.

IGNORABIMUS OR IGNORAMUS?

"We may rightfully say that the course of natural science, irresistible since the time of Galileo, is now for the first time noticeably pausing before the higher part of the brain ... because the brain which, in its highest formation—the human brain—has created natural science is itself becoming the object of this natural science."

I. P. Pavlov thus started his report "Natural Science and the Brain" at the 1909 Congress of Naturalists and Physicians. It was a hymn in praise of the incontestable might of science.

Pavlov continued the heated debate started at the end of last century by Ernst Haeckel and Emile Du Bois-Reymond. The debate went down in science under the title I have given to this story.

In 1872 the German physiologist Emil Du Bois-Reymond ended his public speech "Concerning the Limits of Cognising Nature" with the words: "As regards the riddles of the corporeal world, the naturalist has long since become accustomed to expressing with manly limitation his *ignoramus*. But with respect to the riddles of what are matter and force and how they can think he must once and for all make up his mind to a more distressing confession expressed in the verdict *ignorabimus!*"*

The German biologist Ernst Haeckel resolutely objected to Du Bois-Reymond and his followers, and actively contested the thesis of *ignorabimus*. His book *World Riddles* became the "property of the people and the instrument of the class struggle" said V. I. Lenin who held it in high esteem.

Both Du Bois-Reymond and Haeckel referred to the seven "world riddles", two of them belonging to physics, two to biology, and the last three to psychology:

1. Essence of matter and force.
2. Origin of motion.
3. Origin of life.
4. Expediency of nature.
5. Appearance of sensation and consciousness.
6. Appearance of thinking and speech.
7. Free will.

But Haeckel passionately and convincingly argued that about all these riddles we can say only, "We do not know yet," and, of course, in this respect he was right. It was not without reason that all the sinister forces of the clergy were up in arms against him and stopped at nothing, including lies, slander and even attempts upon his life. We do not know, but we will know, asserted Haeckel and Pavlov, the latter indignantly saying about the bourgeois psychologists: "It is very strange, but they evidently want their subject to remain unexplained!"

The great Russian biologist Kliment Arkadyevich Timiryazev (1843-1920) also heatedly debated with the scientists who shared Du Bois-

* Latin words: *ignoramus*—we do not know; *ignorabimus*—we shall not know.—Ed.

Reymond's views, and addressed the following indignant words to them: "Some mystic ecstasy of ignorance pounding itself on the chest and joyously repeating, 'I do not understand! I won't understand! I will never understand!'"

A good deal of what Du Bois-Reymond considered a riddle is now quite clear to psychologists. And this is precisely what now gives rise to a number of additional questions. Our knowledge may be compared with an expanding sphere. The greater the sphere, the more points of contact with the as yet unknown. This engenders new problems which are yet to be solved.



THE MIND AND THE BRAIN

REFLEX—REFLECTION

According to the Egyptian "Surgical Papyrus", the connections between the mind and the brain were conjectured as far back as 5,000 years ago.

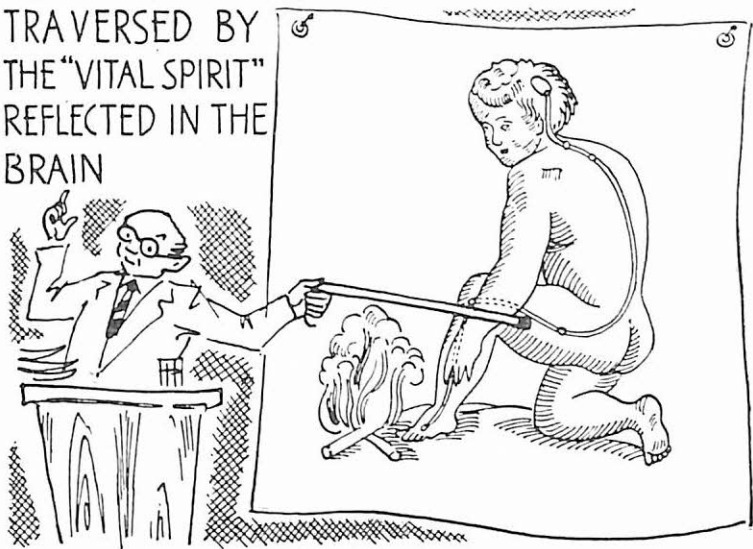
The Greek philosopher Alcmaeon who lived in the 6th century B.C. said that the brain was "the seat of the soul and consciousness". According to other naturalists, the soul resided in the heart; still others localised it in the stomach. The connections between the mind and the brain were given final confirmation by the outstanding French philosopher, mathematician and physiologist René Descartes (1596-1650).

"I am dissecting the heads of various animals to explain the essence of imagination, memory, etc.," Descartes wrote to a friend. The scientist thought that nerves were tubes along which circulate "vital spirits"—particularly light particles of matter which can be reflected by the brain from the sense organs to the muscles. According to Descartes, the tubes contained strands which served as conductors of the external influences to the brain (like, for example, ropes tied to a bell and making it possible to ring the bell). Descartes conceived the entire process as follows: the strands open a valve in the brain, the "vital spirit" rushes from the brain along the tubes, i.e., nerves, to the muscles and by inflating them sets the extremities in motion.

Naïve as it may seem, this scheme contains the correctly understood centripetal (afferent) and centrifugal (efferent) parts of the reflex. Descartes regarded the transition of one of these parts to the other as a transformation of consciousness into bodily movements occurring in the pineal gland which, in his opinion, was the only unpaired organ of the brain.

Descartes' scheme has one more merit. It contains the materialist idea of determinism, i.e., the assertion that there are causal relations between the phenomena of the objective world: one phenomenon (cause) inevitably causes another phenomenon (effect). I. P. Pavlov wrote that "for Descartes

ONE OF THE FIRST REPRESENTATIONS OF A REFLEX
(AFTER DESCARTES) SHOWING THE COURSE
TRAVERSED BY
THE "VITAL SPIRIT"
REFLECTED IN THE
BRAIN



it was precisely the idea of determinism that constituted the essence of the concept of reflex".

All of man's ideas are reflections of the properties and relations of objects and phenomena by man's consciousness. The conception of reflection as the essence of mental activity was developed by Marx, Engels and Lenin into the "theory of reflection", the Marxist theory of cognition. The essence of this theory is that consciousness is considered a function of a specially complex piece of matter—the human brain—and sensation, thinking and other mental processes, nothing but a reflection of objectively existing reality.

The natural science concept of reflex was developed by Sechenov in his remarkable book *Reflexes of the Brain* published in 1863. "He, this scientific psychologist, cast aside the philosophic theories about the soul and undertook a direct study of the material substrate of mental phenomena—the nervous processes." There are reasons to believe that Lenin said this about Sechenov.

HIGH BROW, BUT LITTLE BRAINS

"I was amazed by his beautiful, high brow and large head," a lady acquaintance of mine told me. "Why, I thought, with a big head like that he

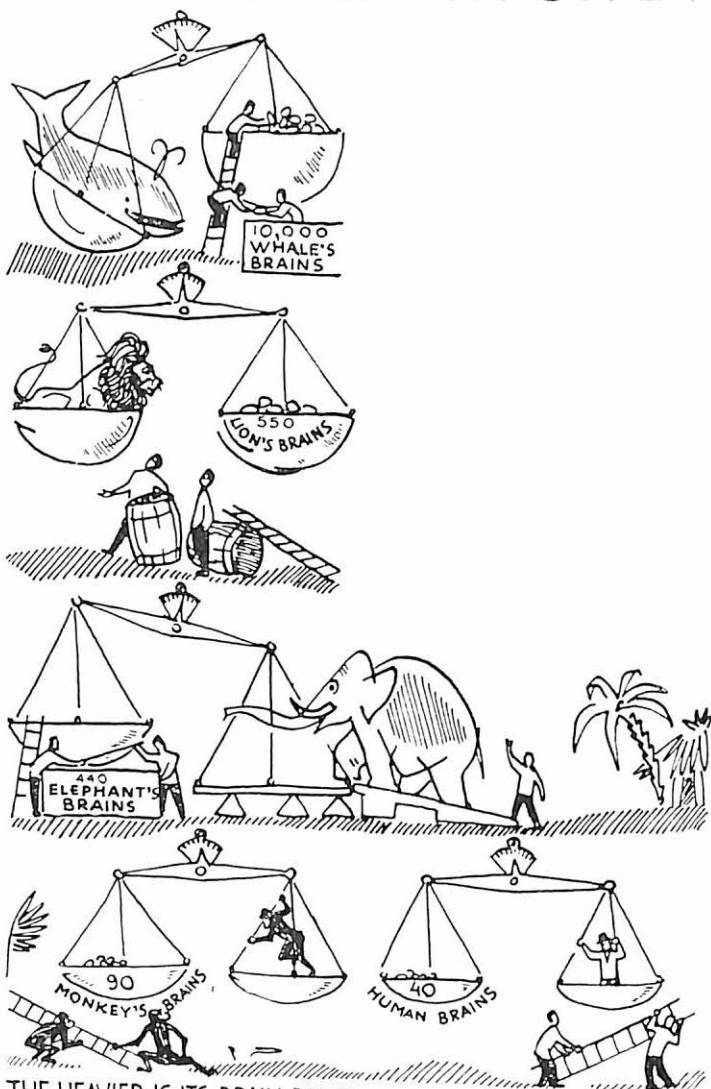
must certainly be a very intelligent and interesting person. But he turned out to be more stupid and vulgar than anyone I have ever met. How come? Isn't there any direct relation between mental development and the size of the brain?"

To answer this question with a single syllable would have been disrespectful; so I had to give her a little lecture. I told her that the relation was not so simple as it might seem. The brain of the elephant is three times as large as that of man, but in man it is $\frac{1}{40}$ of his body, and in the elephant it is only $\frac{1}{440}$.

The higher the development of the animal's higher nervous activity, the greater the relative size of its brain. The average brain volume of the people of our time is 1,450 cc. A skull of primitive man who had lived about 600,000 years ago was recently found in Tanganyika. The volume of this man's brain was 600 cc. A brain volume of 350 cc is characteristic of anthropoid apes.

It is still more evident how the area

THE MORE HIGHLY



THE HEAVIER IS ITS BRAIN RELATIVE TO THE WEIGHT OF ITS BODY,

of the cerebral cortex, especially its frontal parts, depends on the degree of biological development. There comes a time when the cere-

bral cortex can no longer freely fit in the skull, and so it contracts forming fissures and convolutions. The total surface of the cerebral cortex in man averages 2,000 square centimetres, two-thirds of it being located in the depth of fissures.

However, the size of a person's brain cannot of itself serve as an index of development of his mental faculties. The brain of the Russian writer Turgenev, the French naturalist Cuvier and the English poet Byron was very large (about 2,000 cc), whereas that of the German philosopher Immanuel Kant and of the French writer Anatole France was almost half this size.

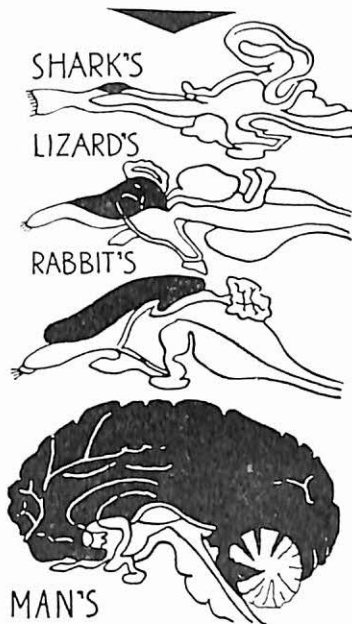
Rather short-witted people may have a large skull and a high brow. A. S. Pushkin's *Ruslan* gives utterance to the following correct idea:

*"I heard the truth said then and now,
That little brains oft come with a high brow."**

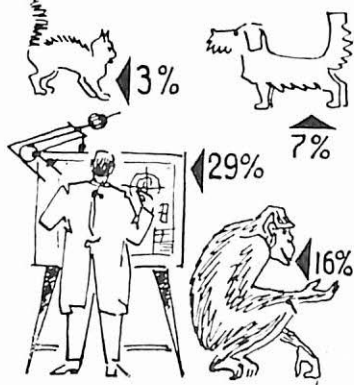
The moral of this story is: do not choose friends by the size of their hats.

* A. S. Pushkin's poem *Ruslan and Lyudmila*.—Ed.

DEVELOPED THE ANIMAL, THE GREATER THE SURFACE OF THE CORTEX RELATIVE TO THE BRAIN,



AND THE GREATER THE SURFACE OF THE FRONTAL LOBES OF THE BRAIN RELATIVE TO THE ENTIRE CORTEX



IS THOUGHT MATERIAL?

The German scientist Oskar Vogt, well known for his studies in the physiology of the brain believed that the relation of thought to the brain was about the same as that of bile to the liver or urine to the kidneys. This was also the idea of the German tanner and self-educated philosopher Joseph Dietzgen (1828-88) who lived in St. Petersburg in the 1860's. V. I. Lenin said that "this worker and philosopher who discovered dialectical materialism in his own way has a good deal of greatness in him".

Dietzgen held that the concept of matter should be extended to include all phenomena of reality, consequently, also our ability to cognise and explain. Subjecting Dietzgen's errors to a detailed analysis in the book *Materialism and Empirio-Criticism* Lenin wrote: "This is obviously false. That both thought and matter are 'real', i.e., exist, is true. But to say that thought is material is to make a false step, a step towards confusing materialism and idealism."

The material phenomena occurring in the brain are the alternation of the processes of excitation and inhibition in the different parts of the cerebral cortex, i.e., the so-called cortical neurodynamics. By ideal phenomena we imply mental processes, for example, sensation, perception, memory, thinking, emotion, volition.

Scientists have not as yet stopped discussing the materiality of thought, which is natural since the connections between the material and ideal phenomena are not yet clear. Science does not as yet have enough information concerning the differences in the chemical composition and physiologic functions between matter that possesses consciousness and that which does not possess it.

The theory of conditioned reflexes and the successfully developing electrophysiology and biochemistry of the brain are bringing man closer to the solution of this problem.

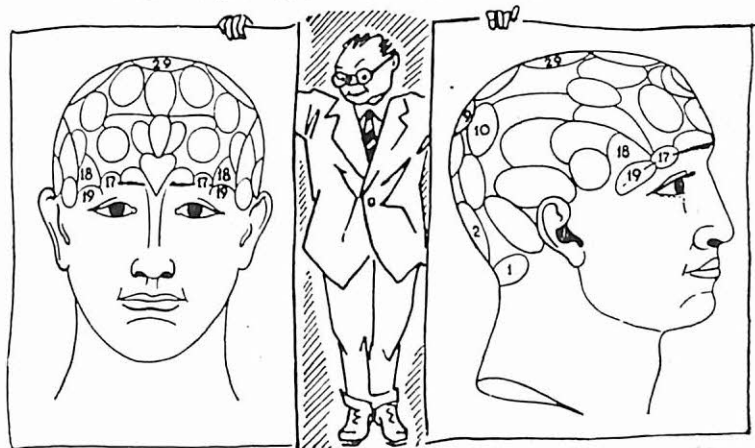
BUMP OF PIETY

My neighbour shaved his head, and his bumpy skull gave his friends grounds for all sorts of wisecracks.

"This bump, here, shows his mathematical abilities," they jested. "That one, there, betrays his vanity. That little one is a sign of musical ability. Look at all those bumps and see how talented the old boy is."

They jested, unaware that last century there had even been a pseudoscience-phrenology (from the Greek word *phren*-mind)-originated by the German physician Franz Gall. According to his "theory" the mental

LOCALISATION OF FUNCTIONS IN THE BRAIN AS CONCEIVED BY GALL



- 1. AMOROUSNESS
- 2. LOVE OF CHILDREN
- 9. LOVE OF AUTHORITY
- 10. LOVE OF FAME

- 17. SENSE OF ORDER
- 18. MUSICALNESS
- 19. CALCULATING ABILITIES
- 29. PIETY

faculties and moral qualities of a person are associated with the shape of his skull; it recognised not only the afore-mentioned bumps, but also a bump indicating love of parents, piety, and many others. Gall ascribed mental activity to the cerebral cortex, which was a progressive part of his views. But he held that an increase in some psychological property resulted in development of a definite part of the brain, which pressed on the skull and formed a bump on it.

The erroneous aspects of Gall's views were utilised for reactionary purposes. For example, a certain Matvei Volkov wrote that the peasants were poor and suffered from privations because they had strongly developed bumps of "antagonism" and weakly developed bumps of "respect". The Russian literary critic Nikolai Aleksandrovich Dobrolyubov sharply rebuffed Volkov, but the German reactionary scientists were delighted with him.

The question of localisation of functions was not so simple as it appeared to Gall. The functions of the different areas of the cortex are associated with the fine microscopic structure of the cortex, its so-called cytoarchitecture.

Man's cerebral cortex is 2-5 mm thick and consists of about 15,000 million cells ranging in size from 0.005 to 0.05 mm. The cells differ in shape and perform different functions. Some of them have up to 10,000 contacts with their "colleagues". They are arranged in six layers and inside the layers—in functional groups.

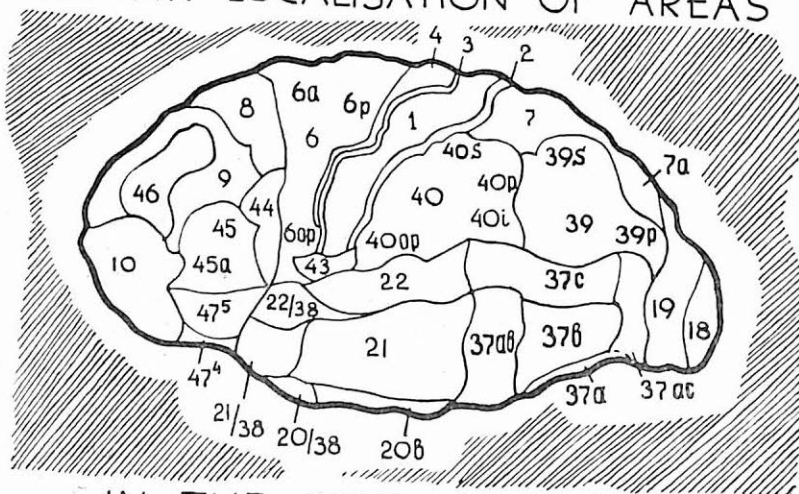
The most perfect chart of the cerebral cortex has been made by the Institute of the Brain in Moscow.

Find numbers 18 and 19 at the lower part of the illustration. They show the parts of the cortex, or the cortical areas, as they are called, whose affection causes blindness in man even if the eyes are intact. Stimulation of these areas, for example, during operations performed on the brain, evokes visual hallucinations. Stimulation of area 22 leads to auditory hallucinations, and its affection—to deafness.

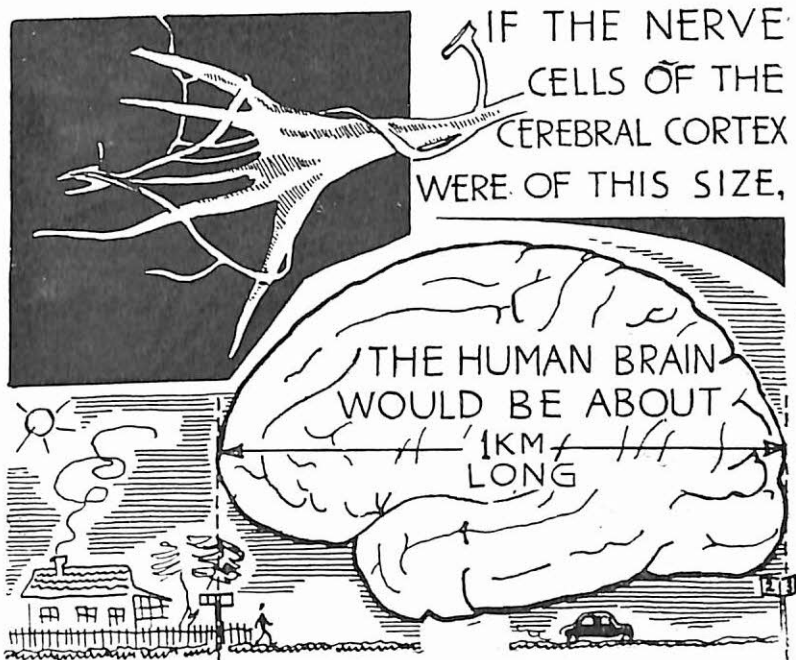
It may now be taken for granted that every form of mental activity is associated with particular centres in the cerebral cortex. Pavlov named this "the structural principle" of the work of the brain, the "fitting of the dynamics to the structure". However, the term "centre" implies not merely a definite part of the cerebral cortex, but the most complex interactions of many cerebral areas which rather easily replace each other. It is the so-called dynamic localisation of functions.

The cerebral cortex has centres which ensure the interaction of the organism and the environment on the basis of signals coming from the external world. This system may be termed "information service".

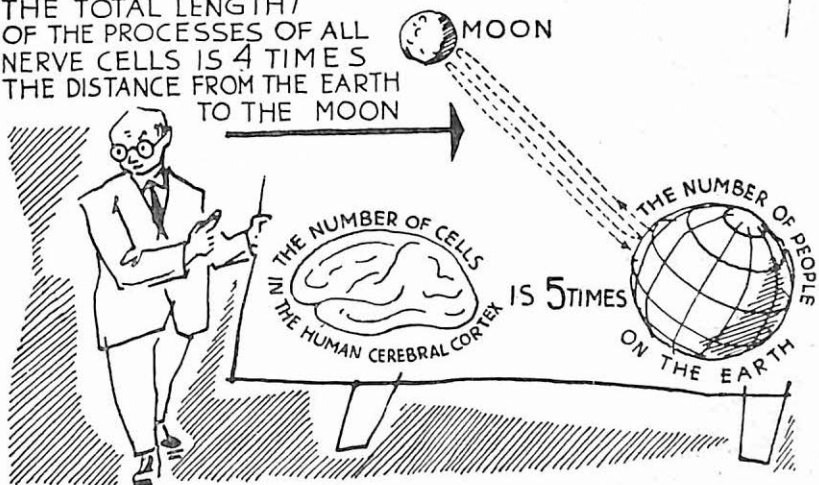
MODERN LOCALISATION OF AREAS



IN THE CEREBRAL CORTEX



THE TOTAL LENGTH
OF THE PROCESSES OF ALL
NERVE CELLS IS 4 TIMES
THE DISTANCE FROM THE EARTH
TO THE MOON

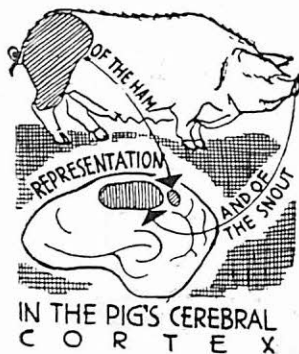


The basic physiologic functions of the organism—respiration, circulation, digestion, heat regulation, etc.—usually unified by the term “vegetative functions”, although associated with the work of the cortex, are regulated by centres located in subcortical ganglions and in the brain stem.

Studies of the past decade have shown that there is one more cerebral system which interacts with both the cerebral cortex and the subcortical ganglions. It is a network of nerve cells surrounding the ventricles of the brain (cavities in the interior of the brain) and called the reticular formation. It is, as it were, the power system of the brain, maintaining the general tone of the cortex. This reticular formation also acts as an “attention service” which I describe separately.

Figuratively speaking, the cerebral centres may be likened to institutions which, although located in separate buildings, sometimes even in different parts of the city, are closely associated and work as a single whole.

The brain is characterised by greatest plasticity and the ability of some of its parts to take over the functions of other parts. The famous bacteriologist Louis Pasteur (1822-1895) had a hemorrhage into the right cerebral hemisphere at the age of 46. The scientist died at the age of 73. The post-mortem examination revealed that he had carried out the remarkable studies which delivered mankind from rabies and immortalised his name with only the left half of the brain because the right half was almost completely atrophied.



REPRESENTATION OF THE PIG'S SNOUT

All organs and parts of the organism have their representations in the cerebral cortex, the sense organs—in its sensory areas and the muscles—in its motor areas. The more important the organ is for the animal or man, the more place does its representation occupy in the cerebral cortex.

The largest area in the cerebral cortex of the pig is occupied by the representation of its snout (much larger than that of the “ham”, i.e., the thigh), in the cortex of the horse—that of the nostrils, and in the cortex of the sheep—that of the

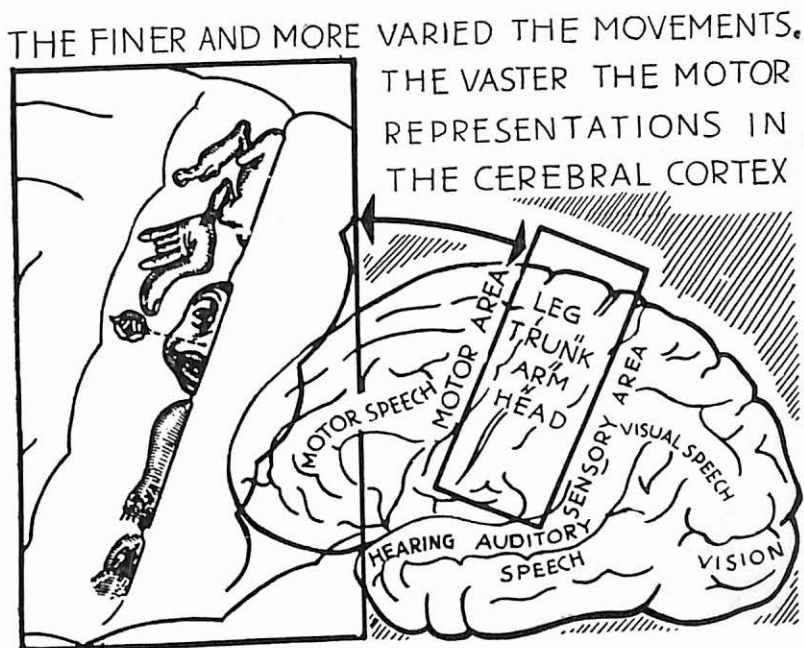
lips. In the hedgehog the olfactory centre occupies about one-third of the cerebral cortex, while in the monkey it is the visual area of the cortex and the representation of the arms and the tail that predominate.

In man the centres which have a particularly specialised representation occupy very small parts of the cerebral cortex whose greater part is associative, unifying the work of the brain in a single whole.

CEREBRAL LITTLE FELLOW

The Canadian scientist Wilder Penfield, who, incidentally, was recently elected member of the U.S.S.R. Academy of Sciences, has made a detailed study of the representation of various muscles in the motor area of the cerebral cortex, in the so-called ascending frontal gyrus. He presented the results of his experiments vividly and entertainingly in the form of a cerebral little fellow. The relative size of the cerebral little fellow's organs corresponds to the relative extent of their representation in the cortex, which in its turn corresponds to their biological significance.

The readers will probably want to know how the cerebral cortex is charted, or, in other words, how the localisation of functions is studied.



There are many methods. It was established as far back as the 1870s that electric stimulation of various parts of the brain causes a tremor of certain groups of muscles. Now that brain surgery is practised on a large scale it is possible to obtain valuable data during operations on the brain not only by observing the patients, but also by speaking to them. The rapidly developing electrophysiologic method is very promising. A good deal of important information has been obtained by comparing the results of clinicopsychological examinations of patients with subsequent post-mortem histological (histology—study of the tissues) investigation of the structure of their brains.

The noted Soviet psychopathologist A. R. Luria attacked the problem from the other end. He worked out a system of methods which permit of an all-round study of various, specially chosen human actions and of unmistakably establishing the affected part of the patient's brain, for example, the site containing a splinter.

Psychopathology is the branch of psychology dealing with the mental processes in disease.

WAR PRISONER OF HIS OWN ARMY

During the Great Patriotic War a Soviet patrol apprehended a relatively mildly wounded man in a Soviet Army uniform and with documents of a Soviet soldier. The man was interrogated, but he did not understand either Russian or German, and in general could neither speak nor write. At the same time he was not deaf, promptly reacted to sounds and even played the guitar.

A medical examination showed that this soldier had been wounded in the left temporal region, in the so-called superior temporal gyrus which contains the "Wernicke centre"—the sensory speech centre described by the German psychiatrist Wernicke in 1871 and named after him. The lesion resulted in a speech disorder known as sensory aphasia. In such cases as this, man ceases to understand his native language.

It was later established that this man thought he had been taken prisoner and that everyone around spoke German.

Eleven years before Wernicke's discovery Dr. Broca had in his Paris clinic a patient whom everybody called Monsieur Tan-Tan. The patient understood everything that was said to him, but could answer only by mumbling, "Tan-tan-tan." In a post-mortem examination Broca discovered in the posterior part of the inferior frontal gyrus a softening resulting from a hemorrhage. It dawned on Broca that he found the centre regulating motor speech.

One year later Broca had another patient like that, and after the patient's death Broca found a lesion in the same part of the brain. The motor speech area was thus discovered in 1861 and was named after Broca.

EXCITATION AND INHIBITION

An interesting experiment was performed at the end of last century by the Italian physiologist Angelo Mosso (1846-1910). He balanced a man lying quiet on special scales. When the man began mentally to solve problems his head grew heavier. The scientist thus proved that mental work is connected with an inflow of blood to the brain and, consequently, an increase in its vital activity.

The following experiment was once conducted. Several dogs were allowed to take a good sleep and rest. A few of them were quickly and painlessly put to death for the purpose of histologically examining the pyramidal cells of their cerebral cortex. The cells proved to be filled with some substance which was named tigroid.

The remaining dogs were forced to run about and become so tired that they could hardly stand up; a few of these were then also killed. No tigroid substance was found in their nerve cells. The other dogs were killed after they had rested, and this time tigroid substance was again discovered in their pyramidal cells.

DURING STRENUOUS MENTAL WORK

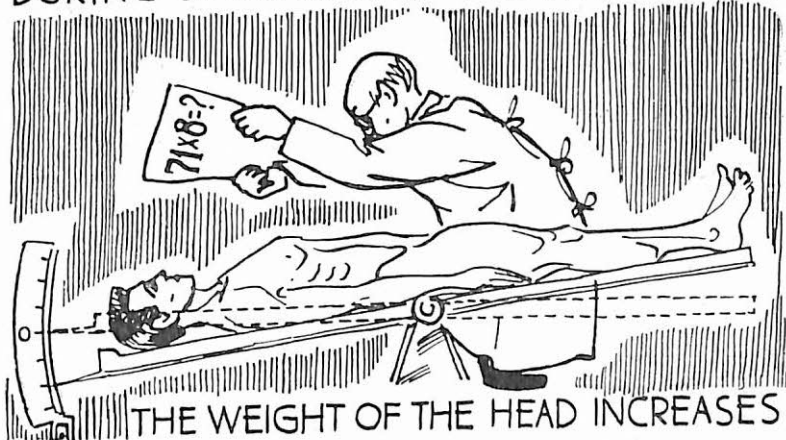
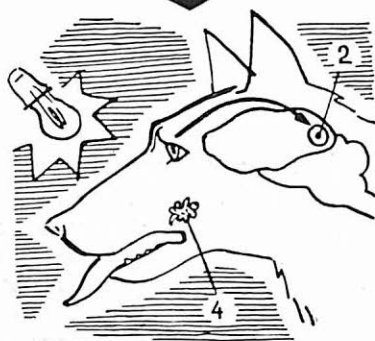
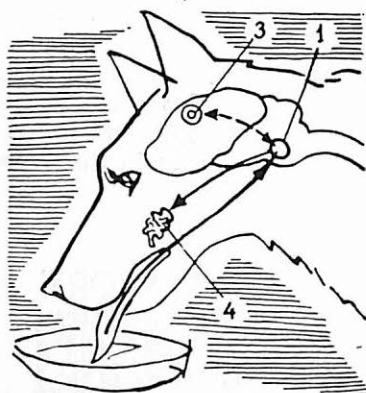


DIAGRAM OF FORMATION

NO REFLEX

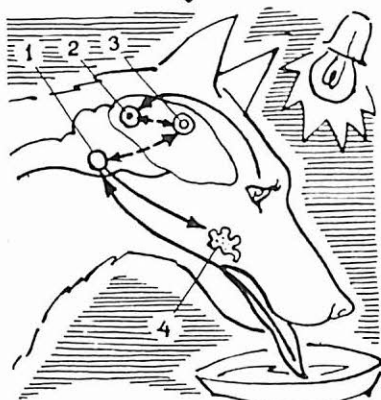


UNCONDITIONED REFLEX

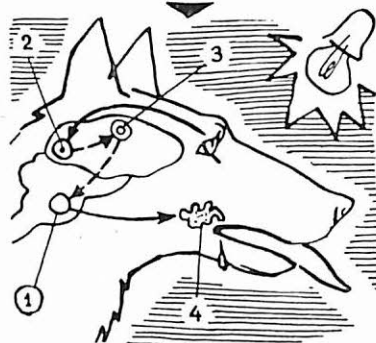


- ① SALIVATION CENTRE IN THE SUBCORTEX
- ② VISUAL AREA IN THE CEREBRAL CORTEX

OF A CONDITIONED REFLEX FORMATION OF CONDITIONED REFLEX



CONDITIONED REFLEX



- ③ SALIVATION CENTRE IN THE CEREBRAL CORTEX
- ④ SALIVARY GLAND

The experiment warranted the conclusion that excitation of the cells is a physiologic process associated with expenditure of nervous substance. It had long been believed that excitation is the only active process in the cerebral cortex and that besides this process there can be only rest. It was later found, however, that there is one more process—suppression of the activity of the nerve centres, i.e., inhibition. Several forms of inhibition are distinguished.

Let us imagine a hot game of volleyball. Suddenly lightning flashes close by and is followed by a deafening crash of thunder. All the players naturally come to a momentary standstill. This is a result of external unconditioned inhibition. It is clear that this state cannot be called rest.

And now remember how a volleyball player who goes after a ball stops in his track upon hearing the term "Out!". At this moment internal conditioned inhibition develops in his pyramidal cells. In this case, too, the cells of his brain are not in a state of rest. On the contrary, they begin to work more actively than if there were no inhibition and the player had hit the ball.

Conditioned inhibition develops by the conditioned reflex mechanism.

And now, Dear Readers, we have come to the question of biologic adaptation which is enormously important to living organisms for it enables them to be always ready to react to any stimulus in its external as well as internal environment.

Well, then, what is a conditioned reflex?

CONDITIONED REFLEX

This most important process underlies all of the higher nervous activity of man and animals.

I. P. Pavlov, the originator of the theory of reflexes, said the following:

"The conditioned reflex is now a physiologic term designating a definite nervous phenomenon whose detailed study has led to the formation of a new branch of animal physiology—physiology of higher nervous activity as the first chapter of the physiology of the higher part of the central nervous system....

"Let us try two simple experiments which anyone can do. Let us pour some moderate acid solution into the dog's mouth. The acid will evoke the animal's normal defence reaction: by vigorous movements of the mouth the solution will be ejected and at the same time saliva will flow copiously into the mouth (and then to the exterior), will dilute the acid and will wash it off the mucous membrane of the mouth. Now the other experiment. Let us stimulate the dog several times by some external agent, say, a certain sound, just before introducing the same solution into the dog's mouth. What will happen? It will suffice to produce the sound alone to evoke the same reaction in the dog, i.e., the same movements of the mouth and flow of saliva.

"Both these facts are equally precise and constant, and both of them must be designated by the same physiologic term 'reflex'.

"The constant connection between the external agent and the response activity of the organism may be legitimately called an unconditioned reflex, and the temporary connection—a conditioned reflex."

"The temporary nervous connection is a universal physiologic phenomenon in animals and man. At the same time it is a mental phenomenon; it is what psychologists call association, whether it is composed of various actions and impressions, or letters, words and thoughts. . . ."

CEREBRAL CORTEX AND INTERNAL ORGANS

In 1944 K. M. Bykov, Pavlov's pupil and follower, thus entitled his book in which he developed his teacher's ideas and showed that the cerebral cortex effects the finest connections of the organism not only with the external, but also with the internal environment.

On the basis of numerous experiments Bykov succeeded in proving that the external factors may influence through the cerebral cortex, all functions, without exception, of absolutely all organs of the human body. Moreover, he found that the signals issuing from the internal organs are capable of forming the same conditioned reflexes that Pavlov had discovered for the signals coming from the external world. For example, the dog's stomach, specially operated for this purpose, is irrigated, and the dog is at the same time fed. After several such combinations, during irrigation of the stomach the dog turns its head to the feeding trough, licks its lips and salivates.

These studies have furnished a physiologic explanation for many phenomena which at one time seemed mysterious. They have explained physiologically the influence of consciousness, thinking and the word on the most diverse functions of the organism. The mysterious psychosomatic—as the bourgeois psychologists and physiologists call them—interrelations are now understood as the organising role of the cerebral cortex which regulates all the functions of the internal organs.

ACTION POTENTIALS OF THE BRAIN

How did the picture that looks like an ancient samurai's helmet or a hair-curling machine get into this book? As a matter of fact it is one of the modern electroencephalographs—an instrument for recording the electric activity of the brain. Action potentials arise in the brain on excitation of the nerve cells of the cerebral cortex, the excited part of the cortex becoming electronegative in regard to the inhibited part. The cortical potentials are very small—hundreds of microvolts.

To study these potentials in animals, their skull is carefully drilled and very fine electrodes are implanted for a very long time in certain parts not only of the cerebral cortex, but also of the subcortex. In man the action potentials of the brain can be studied either during operations on the brain or by means of an electroencephalograph without disrupting the continuity of the skull.



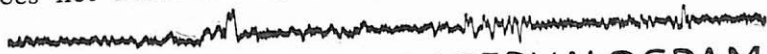
FIFTY-POINT TV SET OF THE BRAIN

The record of cortical potentials on an oscillograph presents a very complex picture of waves of various frequencies and amplitudes. Two main types of waves prevail in healthy man at rest: alpha rhythm—the oscillations occur at a rate of 8-12 per second and are best obtained from the occipital and parietal regions, and beta rhythm—low potential fast waves of 18-35 cycles per second, more constant in the frontal lobes of the brain.

When man begins to solve a problem or makes any other mental efforts, or when his attention is attracted by sudden optic or acoustic stimuli, the alpha rhythm disappears.

When man is fast asleep, delta rhythm—still slower waves (4-5 oscillations per second)—are recorded. The appearance of this rhythm in waking man denotes cerebral disease.

It was recently demonstrated that changes in the alpha rhythm may also be produced by conditioned reflexes. An external influence which, at first, does not affect the alpha rhythm begins to alter it by acquiring


NORMAL ELECTROENCEPHALOGRAM

properties of a conditioned reflex if it is several times combined with a stimulus that affects this rhythm.

Although scientists have now learned to register the action potentials of even a single brain cell, neuroelectrophysiology is nevertheless only making its first steps.

VEXATIOUS MISUNDERSTANDING

The opinions concerning Pavlov's attitude to psychology often differ. Some people maintain that in his laboratory he penalised those who used psychologic terms and often heatedly argued with many prominent psychologists. Others say that whenever Pavlov assembled his associates to analyse the condition of patients he presumably told them that a psychiatrist must necessarily be a psychologist, that he fervently hailed the opening of an Institute of Psychology in Moscow in 1912 and even wanted to establish a psychological laboratory at his Institute in Koltushi.

Both these opinions are correct. Pavlov sought and found an objective method of studying higher nervous activity in animals. He strenuously opposed anthropomorphism, i.e., he was against ascribing the properties of human mentality to animals. While working on dogs by the conditioned reflex method he actually did introduce a fine in his laboratory for the expressions "the dog did not understand", "the dog thinks", etc. He argued heatedly with representatives of idealist psychology and reproached them for their conception of psychology as necessarily instant cognition of the whole. He disagreed with many psychologists who strenuously objected to purely physiologic explanations of the behaviour of man and animals. He very clearly formulated his attitude to psychology at the 1909 Congress of Naturalists and Physicians.

"I should like to obviate the misunderstanding in regard to me. I am not denying psychology as cognition of man's inner world. The less so am I inclined to deny any of the deepest impulses of the human spirit. Here and now I am merely defending and asserting the absolute and incontestable rights of natural-science thought to manifest its power wherever and as long as it *can*. And who knows where it no longer can!"

Unfortunately, the vexatious misunderstanding which he wanted to obviate persisted even after his death.

PATTERN AND GROUNDWORK

Pavlov was fond of speaking of "wedlock of physiology and psychology". He repeatedly tried to "put a psychological pattern against a physiologic background", doing it in his articles, especially in "collective thinking", as he called his weekly Wednesday chats with his associates.

IF THE SKULLCAP WERE TRANSPARENT AND THE EXCITED PARTS OF THE BRAIN APPEARED LIGHT AND THE INHIBITED—DARK, WE WOULD SEE

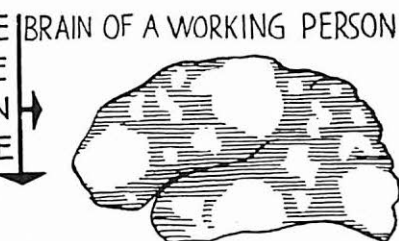
After Pavlov, Soviet psychologists successfully continued to put their physiologic pattern against a physiologic background. You and I, Dear Readers, will also often do it. However, we must always remember Engels's remarkable words which were sometimes forgotten by those who tried to identify mental phenomena with the physiologic processes in the brain. In his *Dialectics of Nature* Engels wrote: "One day we shall certainly 'reduce' thought experimentally to molecular and chemical motions in the brain; but does that exhaust the essence of thought?"

Neither must we forget the words of Engels uttered on another occasion, but applicable to what we are now discussing. "The discovery that heat is a molecular motion was epoch-making. But if I have nothing more to say of heat than that it is a certain displacement of molecules, I should best keep quiet."

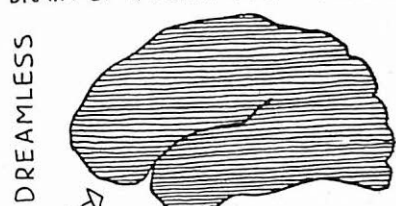
I advise you to remind those of your interlocutors who seeing no forest for the trees, will say about every mental phenomenon: "It is a conditioned reflex and nothing else".

LET US LOOK THROUGH THE SKULLCAP

It is best to finish the chapter "The Mind and the Brain" with Pavlov's words uttered in 1913.



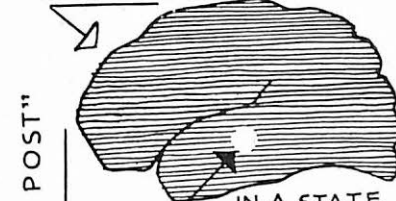
BRAIN OF A SLEEPING PERSON



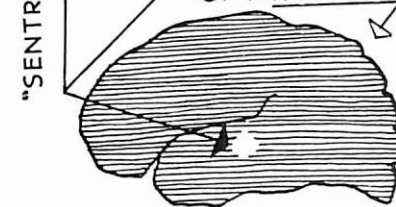
USUAL SLEEP



MOTHER'S SLEEP AT A CHILD'S BEDSIDE



IN A STATE OF HYPNOSIS



"I shall try only presumedly to answer the question: What physiologic phenomena, what nervous processes occur in the cerebral hemispheres when we say that we are conscious of ourselves, when we carry on conscious activity?

"From this point of view I think consciousness is nervous activity of a definite part of the cerebral hemispheres possessing at the given moment and under the given conditions optimum (probably average) excitability. At the same moment the rest of the cerebral hemispheres are in a state of more or less diminished excitability. New conditioned reflexes are easily formed and differentiations are successfully elaborated in the part of the cerebral hemispheres with optimum excitability. Thus, at the given moment, this is, so to speak, the creative part of the cerebral hemispheres. The other parts of the cerebral hemispheres with diminished excitability are incapable of this, and at this time their functions at most consist of formerly elaborated reflexes which arise stereotypically in response to corresponding stimuli. The activity of these parts is what we subjectively call unconscious, automatic activity. The part with optimum activity is, of course, not a fixed part; on the contrary, it continuously shifts all over the cerebral hemispheres, depending on the connections existing between the centres and under the influence of external stimuli. The territory with diminished excitability naturally changes correspondingly.

"If we could see through the skullcap and if the site in the cerebral hemispheres with optimum excitability were luminous, we would see in a thinking, conscious person a luminous spot of oddly irregular contours and continuously changing in form and size move over his cerebral hemispheres, the rest of the hemispheres being rather considerably shaded."

Now, we can add to Pavlov's words, the skull is becoming increasingly more transparent to man's inquisitive eye. This is attested by the dogs who live for a long time with transparent plexiglass windows "built" into their skulls, and the invention of the electroencephalograph. The conditioned reflex method enables our mind's eye increasingly better to see in the brain that which cannot be seen even through a "transparent" skull.

PREHISTORY OF CONSCIOUSNESS

WHERE DOES MIND BEGIN?

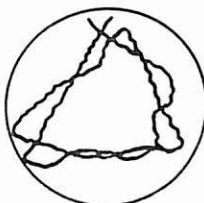
This question has long agitated man. It is now clear to us that consciousness appeared together with speech and under the influence of labour only in man. But what about the mind? The mind appeared simultaneously with the conditioned reflex when some stimuli had come to be "signals" for the animal.

The dog cannot eat sound, and yet sound gives rise to "mental salivation" in the dog. The frog does not react to a human shout, but a light splash makes it seek safety in flight. For the frog it is a signal of danger perceived by another frog which jumped into the water.

And still things are not so simple as they appear. Formation of a conditioned reflex requires a nervous system. The paramecium (unicellular infusorian) does not have one, but try to keep one paramecium for a long time in a small triangular vessel and another one in a square vessel, and each of them will get used to travelling in its vessel in its own way: one describing a triangle and the other—a square.



A



B



C

Now transfer them to a somewhat larger round vessel, and the first paramecium will still run about in the vessel describing a triangle and the other—a square.

Is this the simplest mental phenomenon? This question has no answer as yet.

SURGEON WASPS

It is well known with what mathematical exactness bees build hexagonal cells, as though they understand that geometrically this is the most advantageous form of adjoining areas. But not everybody knows with what striking anatomical precision wasps sting the nerve centre of their victims—beetles, grasshoppers and spiders—before burying them in specially dug holes. The wasps thus provide food for the larvae that will hatch out of the eggs laid on the paralysed victims.

No, that was not a slip of the tongue, for I meant precisely not killed, but paralysed. A dead victim would make bad, rapidly spoiling food. The blow made at the nerve centre with the poisoned stylet paralyses the insect which will later be devoured by the voracious larva.

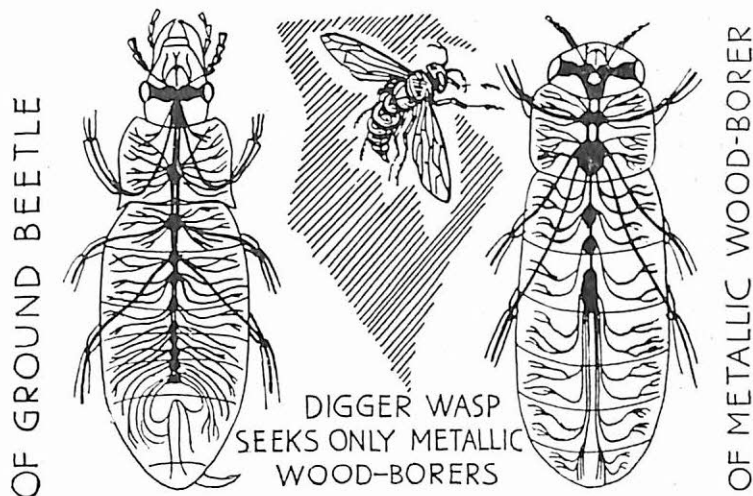
The nervous system of insects consists of accumulations of cells—ganglia—united by commissures—fibres—in a chain. Each part of the insect's body usually has its own ganglion. To paralyse such an insect, the wasp would have to make many stings, which is not only uneconomical, but is also fraught with dangerous consequences for the wasp itself, for isn't only that toreador really good who kills the bull with a single thrust of his sword? However, there are beetles called metallic wood-borers whose nerve centres are concentrated, so that one sting is enough to paralyse them. And of the many existing beetles the digger wasp chooses only the metallic wood-borers.

Don't think that this is reason. It is instinct.

The modest French rural teacher Jean Henri Fabre who won renown at the end of last century by his many years of painstaking observations of and experiments with insects, the digger wasp in particular, wrote in his *Souvenirs Entomologiques* which read like a fascinating novel: "Instinct knows everything in the invariable sphere which is foreordained for it; instinct does not know anything outside this sphere. It is its fate to be simultaneously extremely clairvoyant and surprisingly ignorant, depending on whether the animal acts under normal or fortuitous conditions."

In drier scientific language instinct (from the Latin *instinctus*—instigation, impulse) is defined as an inborn pattern of activity of an animal organism in response to changes in the external and internal environments. Pavlov showed instincts to be compound unconditioned reflexes. He wrote that "from the physiologic point of view no essential difference can be

NERVOUS SYSTEM



found between what is called an instinct and a reflex. The complexity of the acts cannot serve as a difference”.

There are very many instincts and their manifestations are as varied as are the forms of the animals' interaction with surrounding nature. In the final analysis, however, all instincts are based on two instincts: the instinct of self-preservation and the instinct of reproduction. The animals in which these instincts were feeble died out as a result of natural selection without leaving any offspring. The more an animal's behaviour corresponded under definite conditions to these two instincts, the more it was fixed by heredity.

BLIND INSTINCT

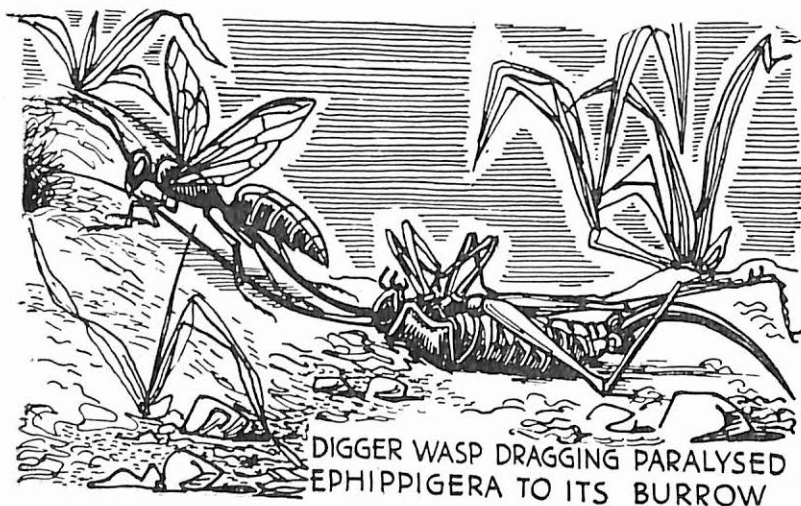
Another wasp—the digger-wasp—studied by Fabre prepares for the food of its larvae paralysed female grasshoppers. Since the prey is too heavy to fly with, the digger wasp drags it along by its antennae. Here is an abridged description of Fabre's experiments proving the blindness of instinct.

First Experiment. “The digger wasp dragging its prey is already a few inches from its burrow. Without touching it I cut the grasshopper's antennae, which serve as reins, with a scissors. The wasp returns and without hesitating drags its prey by the base of the antennae. Very carefully, to avoid hurting the digger wasp, I cut off the remaining part of

the antennae. The digger wasp grasps the long tentacle of her victim and continues her progress. The prey is brought up to the digger wasp's habitation and is placed head towards the entrance to the burrow. The wasp enters her burrow alone, in order briefly to examine its interior before dragging in her prey. I take advantage of this brief moment to grasp the prey, tear off all its tentacles and place it a little farther, a step away from the burrow. The digger wasp appears and goes directly to her game which she sees from the sill of her doorway. She looks all over her victim's head for something to grasp at, but does not find anything. She makes a desperate attempt; opening her mouth as wide as possible she tries to grasp the grasshopper's head, but her mandibles slide off its round and smooth head. She tries and tries again, but without any results. And yet the grasshopper has many places which can be grasped and by which it can be easily dragged. It has six legs and an ovipositor.

"Two hours later I come back to the same place. The digger wasp is no longer there, the burrow is open, and the grasshopper is in the same place."

Second Experiment. "The digger wasp is busy covering up the entrance to the burrow where she had already placed her prey and has laid an egg. I arrived at the time she was working full swing. Pushing the wasp aside I carefully dig a short gallery with the tip of a knife and then, with pincers, and taking care not to demolish the structure, I remove the grasshopper with the egg on its chest from the burrow.



DIGGER WASP DRAGGING PARALYSED
EPHIPPIGERA TO ITS BURROW

"Then I make way for the digger-wasp which was on the look-out close by all the while her habitation was being plundered. Finding the door open she enters her abode and for some time stays there. Then she reappears and begins conscientiously to fill in the entrance to her burrow again, sweeping away the sand and carrying grains of it with such zeal as though she were doing some useful work. The entrance is very well walled up again, and the insect flies away for good."

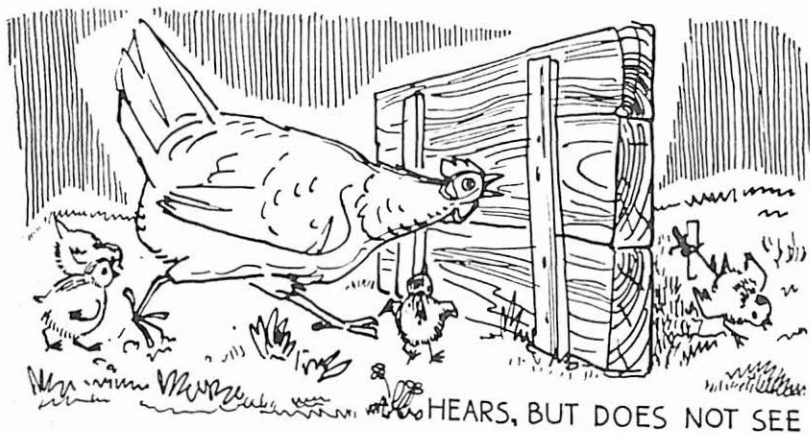
And here is one more experiment performed by Fabre. Placing her prey at the entrance to the burrow before dragging it in the digger-wasp quickly "searches" her habitation. This is expedient since the prey has to be dragged far, and somebody may have got into the "apartment". When the wasp entered the burrow Fabre moved the prey a little distance away; the wasp reappeared, dragged her prey closer to the burrow and dived into the burrow again. Fabre moved the prey away 40 times, and the wasp "searched" her burrow each time, although she could very well see the entrance to it.

ACCUMULATION AND PRODUCTION

The noted Russian zoopsychologist Vladimir Aleksandrovich Vagner (1849-1934) related how a certain naturalist had taken out of a nest, built on top of a pine, two young squirrels which had never before left the nest. At the age of 1 or 2 months they displayed a very interesting instinct. When there were more nuts than they could eat they would look around the room for a suitable place and finding some nook, for example, near a leg of the couch, would press the nuts to the rug and make movements, as though scraping the ground, after which they would leave the nuts.

Under natural conditions, when there is an abundance of nuts, adult squirrels of this species usually bury nuts in the ground, for which purpose they dig little holes, push nuts into them, press the nuts in and smooth out the ground over them. Separated from their parents these squirrels had never seen nuts being buried and therefore laid in their reserves instinctively. It should be noted that this instinct of the squirrels is analogous to a similar instinct of insects, although their common ancestors, the coelenterates, had never laid in any reserves.

Marx and Engels wrote: "The most essential difference between the human society and the society of animals is that the animals at best *accumulate*, whereas humans *produce*. But this one capital difference is enough to make a simple transfer of the laws of the animal society to the human society impossible."



CHICK IN TROUBLE

A chick got in trouble. Somebody has tied its leg to a peg. The mother hen does not see her chick, but upon hearing its cheep instinctively rushes to its aid. Then the German biologist Ixküll—it is he who has tied the chick—covers the chick with a bell-glass. And now, although the hen sees her struggling chick, she calms down because she no longer hears its complaint.

This experiment performed at the beginning of our century proves that the mother hen does not realise the danger threatening her chick, but reacts only to its cheep, i.e., the sound which for her is an unconditioned stimulus. A similar instinctive reaction is sometimes manifested by young human mothers.

Man has long since learned to utilise the reflex of animals to sound in his own interests; he decoys birds and beasts when hunting, calls and drives domestic animals. The following news in this field is curious. It seems that frightened mosquitoes emit a sound that differs from that which they emit when ready to sting. This danger sound, inaudible to the human ear, is imitated by a special device. Kept in the pocket it frightens mosquitoes away better than do all mosquito nets and repellents. By broadcasting through a loud-speaker the danger cry of rooks it is possible to drive them away from the fields and thus protect the crops.

SIC!

A stick is thrown to a well-trained dog, but the dog will not move until given the command "Sic!" But when the command is given the dog rushes into fire and water to get the stick shown to it beforehand.

Does this mean that the dog understands the word?

No, it does not. "Sic!" is only a conditioned sound to the dog. This sound may be replaced by a gesture or a barely noticeable movement of the eyebrows. Many different conditioned stimuli are used on the dog in the process of training, and the dog may elaborate conditioned reflexes to all of them.

DESPITE THE INSTINCT?

Let us recall *The Sparrow*, Turgenev's* remarkable poem in prose.

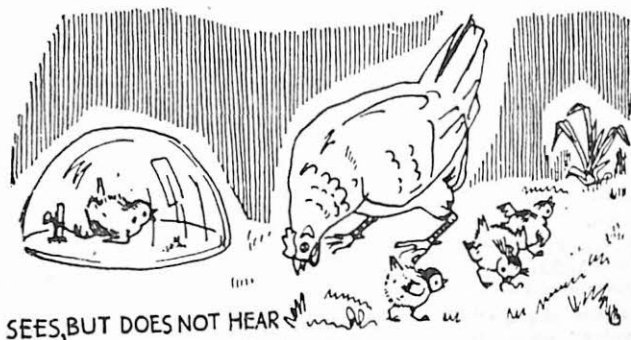
"Once I was returning from the hunt through an alley in the garden, my dog running in front of me, when suddenly his steps slowed down and he began to creep, as if he smelt game.

"I looked down the alley and caught sight of a young sparrow with a downy head and a yellow patch near the bill. He had fallen from the nest (for the wind was violently shaking the birch-trees in the alley), and sat motionless and helpless, his tiny, unfledged wings outspread.

"My dog was slowly approaching him, when, suddenly, an adult, black-breasted sparrow fell like a stone from a near-by branch right in front of his muzzle. Her plumage was all ruffled and awry and, with a despairing pitiful tweet, she hopped twice towards the teeth in those open jaws.

"She had dashed to the rescue and was shielding her baby with her own little body, which trembled all over with fear. Her small voice had become wild and hoarse; she was beside herself with terror, yet she was sacrificing herself!

* Ivan Sergeyevich Turgenev (1818-1883), one of the most popular Russian classics, also very well known abroad.—Ed.



"What a huge monster the dog must have seemed to her! And yet she could not remain in safety on her high branch.... A power, stronger than her will, impelled her to go.

"My dog, Trésor, stopped and drew back.... Apparently he, too, acknowledged that power.

"I hastened to call off the bewildered animal and went reverently away.

"Do not laugh at the word. I felt reverence for that heroic little bird and for her passionate love. Love, I thought, is stronger than death, or the fear of death. Love is life's prop and guide."

In such cases animals at first sight act despite their instincts. But this is not true. It is merely that the instinct of reproduction is stronger than the instinct of self-preservation, which is biologically understandable and expedient. And that was the point made by Turgenev.

DESPITE THE INSTINCT!

In Durov's Corner* one can see a cat peacefully slumbering side by side with rats which keep sniffing at it. Such behaviour which is at variance with instincts is observed mainly when animals are kept under special conditions. Michurin wrote that "with man's interference it is possible to make every form of plant or animal change more rapidly and in the direction desired by man".

But how can a cat, for example, become accustomed to rats?

In cats the olfactory analyser is stronger than the visual analyser. If new-born rats, smeared with the saliva of kittens, are for some time kept together with the kittens and are then placed together at the cat's side, the cat will not only fail to devour them, but will even lick and feed them like her own kittens and will thus get accustomed to them.

In animals with a well-developed cerebral cortex altered conditions, under which manifestation of an instinct becomes inexpedient, easily lead to formation of conditioned reflexes. It is a different matter with insects. Their nervous system is built differently, and conditioned reflexes develop with difficulty; that is why they never behave in a manner out of keeping with their instincts. Since the coelenterates, the animal world has

* Durov's Corner—a natural-science museum and at the same time a zoo and peculiar theatre in Moscow. It houses more than 150 trained animals and birds of 35 different species.

The animals are trained by the method of the famous trainer and scientist V. L. Durov (1863-1939) who utilised the natural habits of his charges and trained them with kindness and encouragement.

The animals show the visitors their acts in cages and also perform on the stage of the "Animal Theatre" where they act in "plays".—Ed.

developed along two ways, and the ants, bees and wasps are the same "acme of evolution" in their branch of development of the animal world, as we, humans, are in ours.

But, although it is difficult, it is nevertheless possible to elaborate conditioned reflexes in insects. For example, if the feeding of bees with sugar is accompanied by the odour of clover, the bees begin to take a great deal more nectar from this plant.

But the evolutionary route of the cerebral cortex which is capable of easily forming conditioned reflexes has led to the appearance of the *Homo sapiens* who is now conquering the cosmos, whereas the evolutionary route of the commissural nervous system has not brought the ants and bees further than the ant-hill and the beehive.

PUNISHMENT OR REWARD?

The famous animal trainer Vladimir Leonidovich Durov had trained in his "school" more than 1,500 different animals and birds. He worked in the circus with animals that could not be trained before him. For example, he had trained a pig, a sheep, a badger and even a capibara (water pig)—the largest rodent, but a very shy animal.

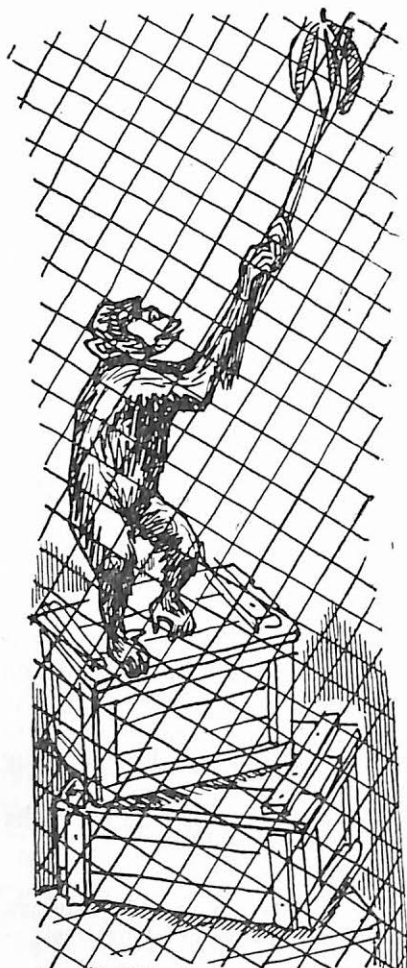
Formerly all trainers had used pain methods. Gypsies used to put a bear on a hot plate and strike a tambourine; the bear "danced" with pain and later, hearing the tambourine performed the same movements on the ground. Horses were spurred in time to music and were made to perform dance steps. Tigers were forced by pricks to jump through hoops or by strokes of a whip to stand in uncomfortable postures.

But Durov's method, as he used to say it himself, was to "motivate the animals to do certain movements".

Revealing his "secret" he said:

"For carrying out their assignments my 'pupils' are nearly always rewarded with sweets, which makes them willingly repeat their assignments several times on end. I call this a taste reward."

One evening I was visiting Durov. I remember he placed on the table before him a new, untrained white rat. Grasping a piece of sugar with pincers and saying: "Turn, turn," to the rat he waved the sugar before its muzzle. As soon as the rat made the slightest movement in the requisite direction he let her nibble at it a little. Then after ceasing to tempt the rat he ordered it to turn again. The moment the rat made the slightest movement he fed it again, making it reach for the sugar. The animal's movements became increasingly more distinct and within hardly half an hour, to the order "Turn!" the rat infallibly made a complete turn after which it was immediately given the appropriate reward.



"YOU ARE, AS THOUGH
PERSONALLY, WITNESSING
THE FORMATION OF OUR
THINKING; YOU SEE ALL
ITS UNDERWATER ROCKS,
ALL ITS WAYS AND MEANS."

U. P. Durov

"You can get a lot more from animals by reward than by punishment," Durov said and after a brief silence added, "and perhaps not only from animals."

ON THE THRESHOLD OF CONSCIOUSNESS

In 1933 a friendly couple appeared in the "capital of conditioned reflexes" as Pavlov called his Institute in Koltushi (near Leningrad). The couple were Raphael and Rosa, two chimpanzees who became the objects of the most careful studies.

It is well known that under natural conditions the higher monkeys greatly resemble humans in behaviour. But in association with man and imitating man they soon learn to eat with a spoon, knife and fork, to crack nuts with nut-crackers, brush their teeth, sleep on a pillow covering themselves with a blanket, and to put on and take off clothing. It is no mere accident that some African tribes believed that gorillas could even speak, but kept it a secret because they knew that, if humans found it out, they would be made to work.

A lot of experiments conducted with the higher monkeys have shown that they can solve very complex problems. To cross from one raft to another on the Koltushi pond the chimpanzee Raphael used a pole as a support or as a bridge. To get this pole, Raphael rowed to the third raft. Despite his instinctive fear of fire the chimpanzee learned to extinguish with water the fire that burned before the box with a tasty bait.

"We have in common with animals all activity of the understanding: *induction*, *deduction*, and hence also *abstraction* ... *analysis* ... *synthesis*, and ... *experi-*

ment.... In their nature all these modes of procedure—hence all means of scientific investigation that ordinary logic recognises—are absolutely the same in man and the higher animals. They differ only in degree (of development of the method in each case)," said Engels. "Without this prehistory the existence of the thinking human brain remains a miracle."

But the chimpanzee's behaviour is perhaps not so much a matter of forethought as afterthought. The chimpanzee is, if we may say so, wise after the event. The well-known Soviet zoopsychologist N. N. Ladygina-Kots observed that the chimpanzee begins to use his decisions correctly only after having tested them in practice. This scientist has performed very many experiments with her chimpanzee Ioni.

Benjamin Franklin's definition of man as an animal that makes tools is therefore incomplete. Of course, not a single animal can make tools like man. But Pavlov's Raphael, for example, could make from a stick a simple "key" to open a lock.

ANIMAL HEROES

As is well known, it is not God who created man "in his own image", as the Bible would have it, but it is man who created the myth of God and endowed him with human traits and qualities, i.e., anthropomorphised God (in Greek *anthropos*—a human being, and *morphe*—form).

It was characteristic of man to anthropomorphise nature, especially in religion and fairy tales. We still find these images in fables and lyric poetry.

In science anthropomorphism lasted the longest in the studies of animal mentality. At the end of last century the eminent German philosopher and psychologist Wilhelm Wundt held that the mentality of animals could be cognised only by being measured with a human measure, and that there could be no other way of cognising it. Opposing this conception Pavlov fined his associates for their voluntary or involuntary attempts to attribute human mental experiences to their experimental dogs.

Anthropomorphisation of animals is in some measure characteristic of many writers who studied and described the life of animals. Take, for example, Jack London: "He (White Fang) learned control and poise, and he knew the law. He achieved a staidness, and calmness, and philosophic tolerance."

The well-known Canadian writer Ernest Seton-Thompson who has taught many children the world over to love animals entitled one of his books *Animal Heroes*. In my youth I was very fond of his books, but when I grew up and became a psychologist I decided that that was a wrong title for a book. An animal could not be a hero in the exact, scientific sense of the word, I argued, since a hero performs acts.

An act, according to the definition accepted in psychology, is that which is done with the doer's cognisance of its social significance. A hero is a person whose deeds are worthy of being known to his contemporaries and the descendants for edification.

But in one of my chats with a youthful naturalist—the little girl's name was Sveta—I was corrected and the little girl proved that the author had very appropriately entitled his book *Animal Heroes*.

"The way I understand the expression 'heroic animal'," she said, "is that it is an animal whose behaviour is such that, if people acted like that, they would be considered heroes. Isn't that right?" she asked cautiously.

"That is right," I answered.

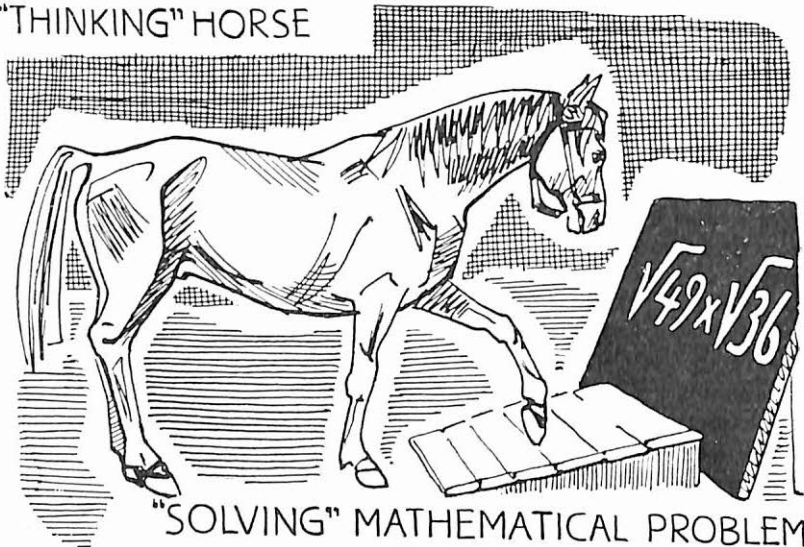
"Well, if that is right, then people can learn something from heroic animals. And we must write books about them," Sveta breathed with relief, and with her all my listeners, and even I, too, felt relieved.

CLEVER HANS

Clever Hans was a horse owned by a German teacher named Osten. In 1904 Clever Hans was known throughout the world since he was, as the newspapers of the time referred to him, "a horse with unusual mathematical abilities".

In 1912 Kral demonstrated to various commissions and numerous journalists in the city of Elberfeld his Arabian horse Muhammed and five more horses who understood German and French, answered questions by

"THINKING" HORSE



"SOLVING" MATHEMATICAL PROBLEM

means of a certain alphabet, could count, solve arithmetical problems and even unusually quickly extract various roots.

Soon afterwards there appeared a dog named Roger; the dog played cards, winning from its opponents, solved arithmetical problems and built sentences from separate letters.

Some people called them "thinking animals", others, who did not care to attribute such high mental abilities to animals, explained this phenomenon by telepathy—reading by Hans, Muhammed and Roger of their masters' thoughts transmitted to them over a distance. Many people considered Osten and Kral mere swindlers.

It was some time before it was possible to establish that these animals were uncommonly capable of perceiving the slightest movements of their masters' eyes, heads, arms and legs, and of reacting to them. Of course, the arithmetical problems were solved not by the animals, but by their masters, the animals merely reacting correspondingly, for example, by beating with their hoofs or responding to their masters' involuntary movements.

"HUMANS OR ANIMALS?"

This is the title the French author Jean Bruller, who writes under the pen-name of Vercors, gave to his novel. On a fantastic example—some-where a large and rapidly reproducing tribe of either primitive man or anthropoid apes was found and named Tropi—the author shows that the borderline between primitive man and the ape is conditional. Vercors subjects to doubt the categoricalness of the well-known definition that man is a social being representing the highest degree of development of living organism on the earth, capable of making tools, using them in his influences on the surrounding world, and possessing a complex brain, consciousness and articulate speech.

As long as the Pithecanthropus and the Anthropopithecus were merely fossil "ape-like" men (our ancestors) the determination of this borderline was only of theoretical importance. It almost became a practical issue when a search for the "snowman" was started in the Himalayas, for, if he were found and the rumours about him were not refuted, the question raised by Vercors would have been very timely. And it will undoubtedly become practical when the people of the Earth meet the beings inhabiting other planets.

If these beings come to us first, they will be highly developed and, consequently, peaceful. I think that Ivan Yefremov, a Soviet science-fiction writer, makes the characters of his story "Heart of the Serpent" awaiting in space a spaceship with people from an unknown planet say the right things:

"There may be a certain analogy between the development of the highest forms of life and the highest forms of society. Man could develop only in a comparatively stable and favourable environment. This does not, of course, mean that there were no changes. On the contrary, there were some rather radical ones—but only in relation to Man himself, not Nature as a whole. Global cataclysms would have made it impossible for the reasoning being to develop. The same applies to the highest form of society capable of conquering space, building spaceships and penetrating deep into the Universe—all this can be achieved only after global stabilisation of conditions of life for the whole of humanity, and, of course, when the disastrous wars accompanying capitalism have been done away with for good. That is why I am certain that the men of another world whom we are about to meet have passed the danger point. They too must have built a truly rational society."

The Earthmen visiting a planet inhabited by beings at a lower stage of development, like the Tropis described by Vercors, will find themselves in a more difficult position.

THE PART PLAYED BY LABOUR IN THE TRANSITION FROM APE TO MAN

"We know that labour and the word associated with it have made us human, but how did it happen?" was written in a note I received after a lecture.

"Many hundreds of thousands of years ago, during an epoch, not yet definitely determinable, of that period of the earth's history known to geologists as the Tertiary period, most likely towards the end of it, a particularly highly developed race of anthropoid apes lived somewhere in the tropical zone—probably on a great continent that has now sunk to the bottom of the Indian Ocean. Darwin has given us an approximate description of these ancestors of ours. They were completely covered with hair, they had beards and pointed ears, and they lived in bands in the trees.

"Climbing assigns different functions to the hands and the feet, and when their mode of life involved locomotion on level ground, these apes gradually got out of the habit of using their hands in walking and adopted a more erect posture. This was *the decisive step in the transition from ape to man*.

"If erect gait among our hairy ancestors became first the rule and then, in time, a necessity, other diverse functions must, in the meantime, have devolved upon the hands....

"The first operations for which our ancestors gradually learned to adapt their hands during the many thousands of years of transition from ape to man could have been only very simple ones....

"Thus the hand is not only the organ of labour, *it is also the product of labour*. Labour, adaptations to ever new operations, the inheritance of muscles, ligaments, and, over longer periods of time, bones that had undergone special development and the ever-renewed employment of this inherited finesse in new, more and more complicated operations, have given the human hand the high degree of perfection required to conjure into being the pictures of a Raphael, the statues of a Thorwaldsen, the music of a Paganini.

"Mastery over nature began with the development of the hand, with labour, and widened man's horizon at every new advance. He was continually discovering new, hitherto unknown, properties in natural objects. On the other hand, the development of labour necessarily helped to bring the members of society closer together by increasing cases of mutual support and joint activity, and by making clear the advantage of this joint activity to each individual. In short, men in the making arrived at the point where *they had something* to say to each other. Necessity created the organ. . . .

"First labour, after it and then with it speech—these were the two most essential stimuli under the influence of which the brain of the ape gradually changed into that of man, which for all its similarity is far larger and more perfect. Hand in hand with the development of the brain went the development of its most immediate instruments—the senses. . . .

"The reaction on labour and speech of the development of the brain and its attendant senses, of the increasing clarity of consciousness, power of abstraction and judgement, gave both labour and speech an ever-renewed impulse to further development. . . .

"By the combined functioning of hands, speech organs and brain, not only in each individual but also in society, men became capable of executing more and more complicated operations, and were able to set themselves, and achieve, higher and higher aims.

"The animal merely *uses* its environment, and brings about changes in it simply by its presence; man by his changes makes it serve his ends, *masters* it. . . ."

This is how I answered the question—by adducing quotations from Engels's work I used as the title of this section.

HERD AND COLLECTIVE

"What an enormous ant-hill! I wonder how life is organised in this collective?" exclaimed Sveta watching some ants rushing about, while others followed each other, as though along a path, somewhere away from the ant-hill.

To be sure, the organisation of life in an ant-hill is very complex. Here, as in a beehive, there is a female which lays eggs, there are workers who do all the main work in it, and there are larger soldiers who are armed with sharp jaws. Winged males also live there for some time. The ants go on campaigns, wage wars with their neighbours, steal eggs and larvae from other ant-hills, cultivate fungi, care for and milk plant-lice. And still an ant-hill, like a swarm of locusts and like any other accumulations of animals, is only a herd in which the behaviour of each individual is determined mainly by instincts and, to a very slight extent, by conditioned reflexes.

A herd may be very complex and permanent, and sometimes temporary. It may even unite different species of animals.

Hares finding themselves in an area where there is a herd of deer unite with the latter. In doing this they lose their habitual alertness and calmly run and skip about, while the alert deer also graze tranquilly. The carefree behaviour of the hares ceases immediately after departure of the deer herd.

Primitive monkeys also lived in herds or troupes.

Engels wrote: "Hundreds of thousands of years—of no greater significance in the history of the earth than one second in the life of man—certainly elapsed before human society arose out of a troupe of tree-climbing monkeys. Yet it did finally appear. And what we do find once more as the characteristic difference between the troupe of monkeys and human society? *Labour.*"

When we speak of "social" animals we do so somewhat conditionally because only man is a truly social animal.

The following is perhaps the best definition of a collective given by Anton Semyonovich Makarenko: "A collective is possible only providing it unites people on the basis of activities clearly beneficial to society. Primitive man united in collectives for hunting. Without a common and necessarily conscious aim there is no collective, but only a group, an accumulation of people. The more conscious the members of a collective are of the aim of their common activity, the more solid is the collective. Communist work teams are the highest form of a modern collective."

UNDER HUMAN INFLUENCE

"In a state of nature, no animal feels handicapped by its inability to speak or to understand human speech. It is quite different when it has been tamed by man. The dog and the horse, by association with man, have developed such a good ear for articulate speech that they easily learn to understand any language within their range of concepts. Moreover they

have acquired the capacity for feelings such as affection for man, gratitude, etc., which were previously foreign to them. Anyone who has had much to do with such animals will hardly be able to escape the conviction that in many cases they *now* feel their inability to speak as a defect. . . . Teach a parrot swear words in such a way that it gets an idea of their meaning (one of the great amusements of sailors returning from the tropics); tease it and you will soon discover that it knows how to use its swear words just as correctly as a Berlin costermonger."

Engels thus described the multifarious influences of man on the higher nervous activity of animals. And here is a case reported in the newspaper *Pravda* of December 9, 1936, confirming Engels's foregoing view.

This happened on the Soviet-Manchurian border. The boat in which two border guards and a dog were sailing down the Suifen River got into a breaker and capsized. Both men and the dog were thrown into the water. The dog quickly swam ashore, got out and sat on the bank, waiting for his master.

A wet greatcoat, rifle, heavy cartridge pouch, grenades and boots are too much of a burden for a swimmer. The border guards began to drown. One of them called on the dog for help. The dog swam up to his master and tearing the helmet off his head swam back ashore. The border guard was drowning; he called to his friend once more and disappeared under the water. The dog let go of the helmet and dived. He grasped his master's shoulder with his teeth, brought him to the surface and started swimming ashore. When his master was out of danger he rushed to the rescue of the other guard.

"I have never cried in my life," the first border guard related later. "Nor do I believe my mate to be particularly fearful. But if you could have seen the dog jump between the two of us, licking our hands and faces and manifesting his joy at our safety, you would not have reproached us for the tears we had shed that night on the bank of the Suifen River."

BEE AND ARCHITECT

But let us go back to the wasp with whose story I began this chapter, or, to be exact, to the bee which, like the wasp, builds cells.

Checking up on the solution of the "bee's problem" a British mathematician arrived at the conclusion that bees somewhat err because they make angles of $70^{\circ}32'$, while they should be making angles of $70^{\circ}34'$. A subsequent check-up showed, however, that it was the mathematician who erred because of a misprint in the table of logarithms and that bees solve their problem correctly.

But what then is the chief difference between the human mind and the mentality of an insect or an animal, the chief difference that determines all the other differences?

This question was answered by Karl Marx. He wrote:

"A spider conducts operations that resemble those of a weaver, and a bee puts to shame many an architect in the construction of her cells. What distinguishes the worst architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. At the end of every labour process, we get a result that already existed in the imagination of the labourer at its commencement. He not only effects a change of form in the material on which he works, but he also realises a purpose of his own that gives the law to his *modus operandi*, and to which he must subordinate his will."

This main difference is not at all due to the fact that man and the bee are on the peaks of two different branches of development of the animal kingdom. What Marx said about the bee equally applies to the octopus, the swallow, the beaver and any other animal. Similar conditions have led, by the law of analogy, to production of similar forms of mentality in the different branches of the animal kingdom.

Only the appearance of consciousness has singled man out.

Chapter 4

PERCEPTIONS

THE SIXTH SENSE

Man was formerly believed to have five senses—vision, hearing, taste, smell and touch. And only poets, who perceive the world somewhat differently, more finely and deeply, were thought to have a "sixth sense". Was this justified?

Shut your eyes, assume any posture, stand "at attention" and then resume the former pose. Which of the five aforesaid organs enabled you to repeat the movement?

It was the "sixth sense"—the kinesthetic sense, i.e., the sense of perception of movement, weight, resistance and position; this sense is evoked by stimulation of special receptors (peripheral nerve endings) present in the muscles, ligaments and joints.

In walking, dancing and cycling you become aware of the change in speed or direction of your movement owing to the vestibular apparatus of the internal ear. It is this apparatus that perceives the change in the position of the head and the direction of the body's movement. Moreover, you feel hunger, thirst, abdominal pain, etc. All these are interoceptive senses, i.e., senses based on impulses received from the viscera, or from the interior of the body.

This goes to show you how many "sixth senses" any man, and not only a poet, has, although in all these cases it is more appropriate to speak about sensations and analysers than about senses and sense organs. The "sixth sense" to which poets refer is the sense of the beautiful and intuition, which we have already discussed.

"An analyser is a complex nervous mechanism which begins with an external receiving apparatus and ends in the brain," explained Pavlov. For example, the visual analyser is composed of the eyes, optic nerves and the visual areas of the cerebral cortex. We see not only with our eyes, but with the entire visual analyser as a whole, hear with the auditory analyser, etc.

The action of the external world on the analysers causes various sensations. "We can have no knowledge of any forms of substance or any forms of movement other than through the senses," wrote Lenin who defined sensation as the "result of the action of matter on our sense organs", as a "subjective picture of an objective world", a world existing independent of man's consciousness, a world cognised and changed by man in his activity. It is precisely this Leninist concept of sensations, the Leninist theory of reflection that is the foundation on which materialist psychology is built.

THE MOST SENSITIVE APPARATUS

We become aware of the odour of musk when its concentration is 0.00004 mg per litre of air. Imagine 100g of musk dissolved in a lake 1km long, 250m wide and 10m deep, and you will have the aforesaid concentration.

Engineering has nothing to offer when it comes to the concepts of "taste" and "aroma". No apparatus can take the place of tasters—persons of a rare occupation—and not a single international tea, coffee, tobacco or wine auction can do without tasters; nor can new sorts of these products be created without them.

The human eye is a still more sensitive apparatus. It distinguishes about half a million colours and hues. If the air were entirely clear, we should be able to see a candle flame 27 km away. A flash of light lasting 0.0003 sec can already be perceived by the eye. The energy that causes a barely perceptible visual sensation is so low that it would take 60 million years to heat 1g of water 1°C. It will be remembered that one discharge of lightning lasts 10^{-4} sec and the entire flash of lightning—0.01-0.1 sec.

Water vapours and dust sharply deteriorate the visibility of an object; that is why a bonfire is practically seen only 6-8 km away, a pocket flashlight and a lighted match—about 1.5 km away, and the light of a cigarette—0.5 km away.

Engineering does not know of such sensitive apparatus as the human eye. And still Hermann Helmholtz (1821-1894), the famous German physicist and physiologist who laid down the foundations of physiologic optics, found in the eye quite a few physical shortcomings which warranted his following statement: "If an optician wanted to sell me an instrument with the afore-listed shortcomings, I should express my disapproval of his work in the strongest possible terms and should return it to him." My teacher, who as a young man had worked with Helmholtz, told me that the latter was fond of saying:

"If God had consulted me when creating man, the eye would have been better."

GOOD EYES

If you want to learn flying, you will have to have your eyes examined, and should your visual acuity be less than unity you will be turned down. How is visual acuity determined?

The acuity of vision, or the refractive power of the eye, is measured by the smallest angle at which man can still see two points separately. When it is unity this angle is $1'$; when the acuity of vision is 0.5 it is $2'$, and when it is 0.1 the angle is $10'$. With a visual acuity of unity the corresponding linear representation of two points on the retina is 0.005 mm which is close to the mean diameter of one visual cell—a cone. The acuity of vision is tested by specially calculated tables.

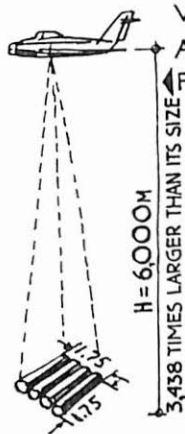
The Indians hold that a person has a "good eye" if he can see "the child behind the squaw's back", i.e., distinguishes near Mizar (star of the first magnitude and the middle star in the handle of the Big Dipper) Alcor (star of the fifth magnitude). The distance between these stars is not $1'$, but about $12'$, but then we do not perceive stars as points.

Helmholtz explained this as follows: "The representations of light points received in the eye are irregularly radiant. The reason for it lies in the crystalline lens whose fibres are arranged radially in six directions. The rays which appear to us as issuing from luminous points, for example, from stars or distant lights, are no more than a manifestation of the radial structure of the crystalline lens. The extent to which this eye defect is universal is evident from the fact that every radially-arranged body is usually called star-shaped."

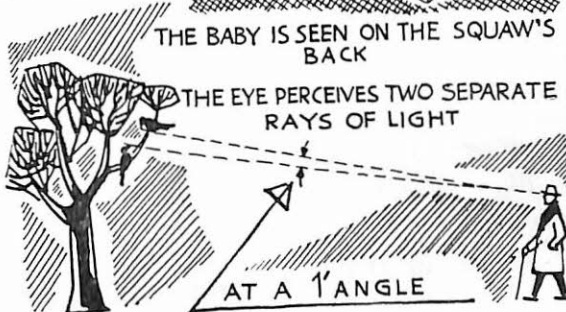
WITH A 1.0 ACUITY OF VISION

YOU CAN DISCERN AS A BARELY

VISIBLE POINT
AN OBJECT
FROM A DISTANCE



THE BABY IS SEEN ON THE SQUAW'S BACK



THE EYE PERCEIVES TWO SEPARATE
RAYS OF LIGHT

AT A $1'$ ANGLE

About 400 years before Helmholtz, Leonardo da Vinci advised how stars could be seen as points without shining.

"Look at stars without rays. This can be done by observing them through a small hole made by the tip of a thin needle and placed close to the eye. You will see the stars so small that nothing else appears smaller."

Look at stars in the manner advised by Leonardo da Vinci and you will find him to have been right. You will thus also be able to get a much better view of the "squaw and child". The reason for it is that through a small hole we let only a thin pencil of rays pass into the eye. The pencil of rays passes through the central part of the crystalline lens and therefore does not change under the influence of its radial structure.

SENSATION THRESHOLD

Gera and Lena had an argument about whose hearing was better.

"Why argue?" I cut in. "We can check up on it right away. Sit down, side to side, at a distance of about one and a half metres and shut your eyes. I shall bring my watch close to each of you alternately. As soon as you hear the ticking say, 'I have it,' and the moment you no longer hear it, say, 'Gone.' We will thus determine in relative linear, but quite comparable values the absolute threshold of your auditory sensations."

The question I was immediately asked was, of course:

"And what is this absolute threshold?"

I answered my youthful friends about as follows:

"The absolute sensation threshold is the lowest, barely perceptible limit of sensation. It goes without saying that for greater precision the auditory threshold must be determined by means of an audiometer—an instrument emitting sounds of precise pitch and strength—and a so-called audiogram must be recorded. The threshold for sounds of different pitch varies with individuals.

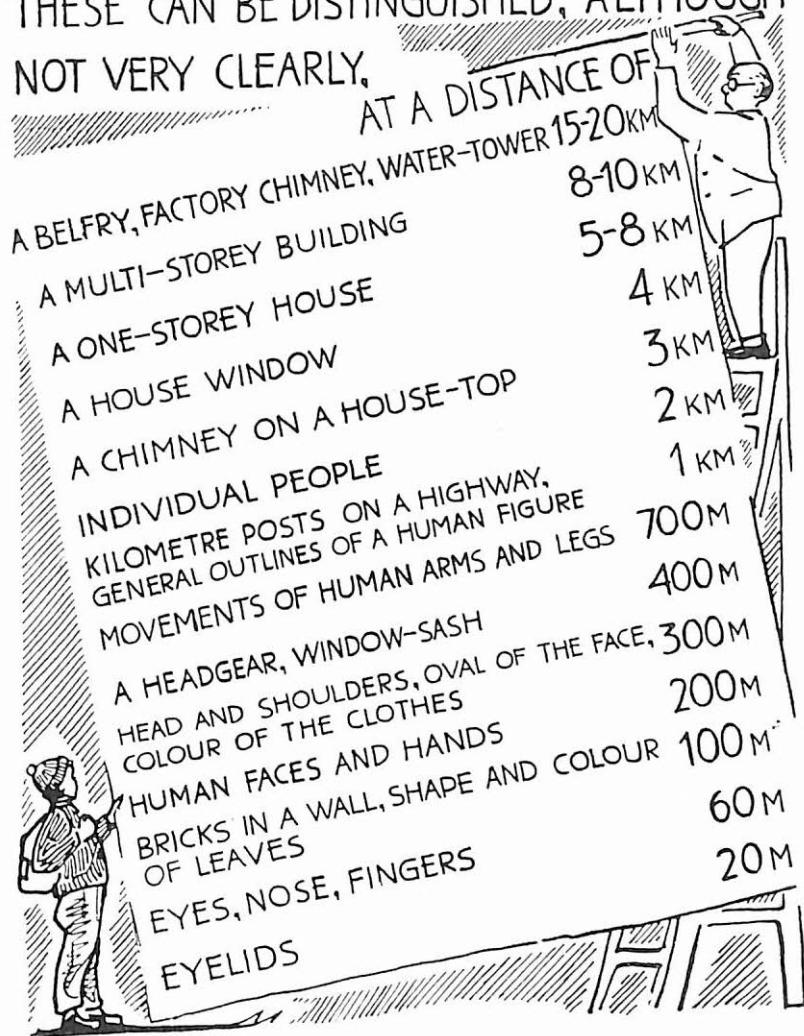
"In our experiment we might also determine the relative threshold, or differential, i.e., the lowest limit at which two stimuli can be discriminated."

THIS WAY YOU CAN HEAR



LOUD SOUNDS OF A BELL

THESE CAN BE DISTINGUISHED, ALTHOUGH
NOT VERY CLEARLY.



I brought the watch closer to Lena's ear and asked her to say when the watch ticks louder and when more faintly. The distance to which I moved the watch so that Lena might perceive the difference in its ticking determined the differential threshold in relative linear values.

At first we estimated the results of these experiments by sight and then ascertained them with the aid of a ruler. By measuring the thresholds

several times it is possible to obtain more precise mean arithmetical values.

The argument was settled as follows: Gera had a higher absolute auditory threshold and Lena—a higher differential threshold.

Should you happen to lay your hands on a tuning fork, try the following experiment: strike it, then bring it close to the ear and listen to its sound until it drops below the threshold and you can no longer hear it. Then press the stem of the tuning fork to your forehead and you will again clearly hear the sound. Bone conduction of sound is better than air conduction.

Utilisation of visual thresholds is of practical importance. Since objects of various sizes are clearly seen only at definite distances, it is also possible to determine the distances to these objects by their visibility. Tourists and hunters know this and use tables like the one shown on the next page. It should be remembered, however, that exact determination also depends on the limpidity of the air, the acuity of vision and the experience of the looker.

"The eagle sees much farther than man, but the human eye discerns considerably more in things than does the eye of the eagle," said Engels.

The thresholds determine only the quality of sensation (such as the reflections of various properties of objects and phenomena of the material world, which act directly on the analysers), whereas the quality of perception (as the reflections of these objects and phenomena in the aggregate of their various qualities) depends on experience, the ability to see precisely what must be seen in the given case.

Old navigators have a saying: "We must not merely look, but must also see." This applies not only to visual sensations and perceptions, but also to auditory and all others.

Try to smell common salt, and if it is pure you will smell no odour. Nor do we smell the odour of quinine. But the dog smells common salt and quinine even in a 1:10,000 water solution, i.e., 1g dissolved in a bucketful of water. But we perceive the differences in common salt and quinine much more fully and many-sidedly than does the dog.

When I related all this in a company of friends in which we tested the acuity of hearing everybody agreed that Gera heard much better than Lena, but Lena's ear discriminated much more in music. Lena is fond of music and can listen to it, whereas for Gera music is merely so much noise, although he has a sharper ear.

AT THE WINDOW OF A RAILWAY CARRIAGE

Through the windows of a contrary train we see the landscape almost as clearly as we do through the windows of our own railway carriage, but in barely perceptible flashes. If the relative speed of two contrary

trains is about 35 m/sec and the distances between the windows are about 1 m, the continuity of the landscape will be interrupted for 0.03 sec. This is calculated by the formula of the rate of uniform movement $V = \frac{S}{t}$, hence the duration of the interruption in the landscape:

$$t = \frac{S}{V} = \frac{1\text{m}}{35\text{ m/sec}} \approx 0.03\text{ sec.}$$

Through the windows of a passing train one can clearly see the opposite platform even if its picture is interrupted for 0.06 sec.

Looking through a train window at the embankment we see continuous, merging lines. By gradually shifting our eyes we can distinguish three zones: merging, flashing and clear vision of individual objects.

Snow appears to fall fast, close by and slowly at a distance. Leonardo da Vinci wrote that "nearby snow seems an uninterrupted continuity, like a white thread, whereas distant snow appears interrupted".

The borderline between the zone of flashing and the zone of merging at which the flyer is looking helps him to judge the distance from the ground in landing.

Ptolemy who lived in Egypt 1,800 years ago performed the following experiment which was later given his name. He took a circle and painted one red radial strip on it. If you spin the circle fast before the eyes, all of it will appear painted red. Everyone of us must have repeatedly performed Ptolemy's experiment with a coloured top.

Newton painted sectors of a circle the seven primary colours of the spectrum. On rotation the colours blend and "Newton's circle" appears white.

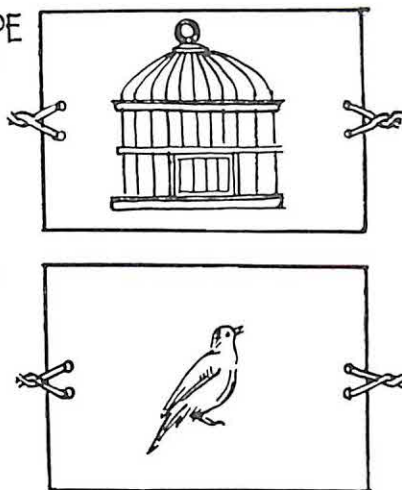
All this occurs because the image of the object arising in the visual analyser does not disappear immediately after the stimulus has ceased acting. It is retained for some time as a so-called successive image. The successive image is retained for about one-thirtieth to one-fifth of a second, but this time differs in different people and in the perception of different objects. The least number of stimuli per second at which the sensation of flashing disappears and the images blend into one image is called the critical flashing zone.

ANCESTORS OF THE CINEMA

Take a sheet of cardboard and tie two strings to its sides. Draw a cage on one side and a bird on the other, or a horse on one and a rider on the other side. Now spin the cardboard holding the strings taut and you will see the bird in the cage or the rider on horseback.



DOCTOR PARIS'S THAUMATROPE



Such a toy made in 1825—Doctor Paris's thaumatrope—was the first ancestor of the modern cinema. It was followed by books with successively changing drawings on each page. When these drawings were rapidly released from under a finger the pictures came to life.

Then in 1833 appeared the stroboscope with pictures moving in its opening. In 1891 Edison made the kinetoscope in which 1,440 pictures were shown at the rate of 48 per second. For 30 seconds the spectators saw a moving image. Lastly, the Lumière Brothers connected the kinetoscope to a projector. This was already cinematography—at first an attraction and then a new form of art.

I have given a very incomplete account of the history of invention of cinematography in order to show that it is based on successive images. If the frames on the screen succeed each other too rapidly they blur, if too slowly—they begin to flash. But if they are demonstrated as it is done today—at the rate of 24 frames a second—they are perceived as a moving, living picture.

EFFECT OF PARTICIPATION

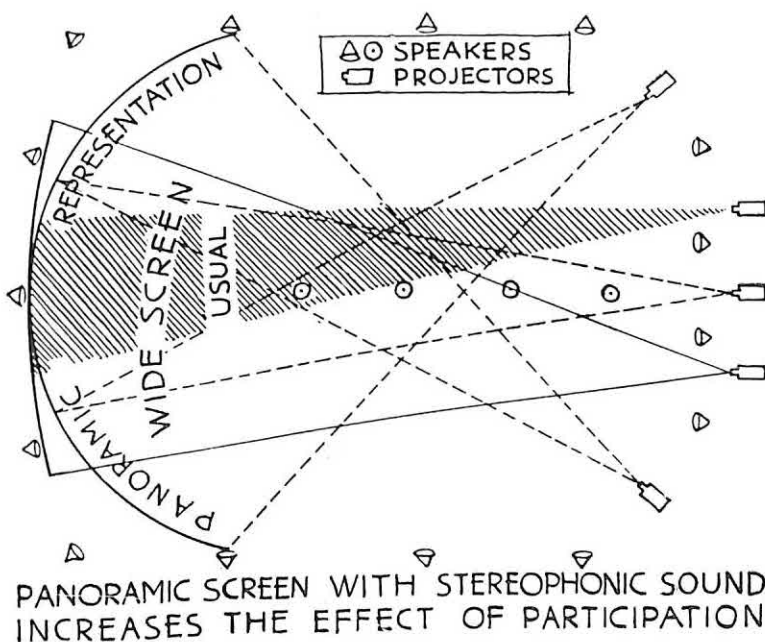
In the "Train Arrival", one of the first films produced by the Lumière Brothers, the locomotive appearing in the depth of the screen rushed towards the spectators, scaring them out of their seats.

When the spectator forgets that he is in the cinema and considers himself, as it were, a participant of the events taking place on the screen he experiences the so-called "effect of participation".

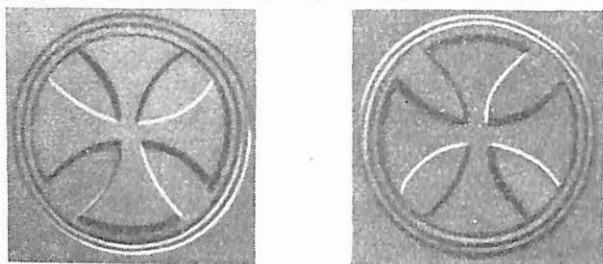
Now it seems strange to watch old contrast, black-and-white films which at one time evoked such lively emotions in the spectators. The improved cinematographic engineering and the greater artistry of the producers, cameramen and actors undoubtedly enhance the effect of participation. This became particularly clear when the once "great silent" spoke up, when the black-and-white films were replaced by technicolour, when the screen became broad, then semi-circular panoramic and, lastly, round ("circorama"), and when the sound became stereophonic, i.e., reaching the spectators from different parts of the screen and the hall.

A narrow screen is a window into an alien world in which the spectator sees only what he is shown; but if the film is demonstrated on a broad screen each spectator is free to choose where to look. This active choice enhances the effect of participation. The very same film is perceived differently in its broad-screen stereophonic and usual narrow-screen versions.

The effect of the spectator's participation has now become so great that the film sometimes loses its artistic value as, for example, in cases where the spectator in the panoramic motion picture theatre becomes sea- or air-sick.



IMPORTANCE OF SHADOWS IN PERCEPTION OF DEPTH



WHAT WILL HAPPEN IF WE TURN
THE PICTURE UPSIDE DOWN?

DEPTH-ESTIMATING EYE

Suspend from a chandelier by a thin thread a curtain ring or a ring made of wire by yourself. Shut one eye, stand with the ring sideways to you so that you do not see the hole, and try to put a thin switch or wire through the hole. You will find that this is not a simple task.

When you look with one eye (monocular vision) the impression of depth and perspective is considerably diminished. You open the other eye, now looking with both eyes (binocular vision), and find it very easy to do the trick with the ring and wire.

To gain an understanding of the mechanism of depth vision, try also the following experiment. Try to look at one of your fingers, first moving it farther away, then gradually bringing it closer to the nose and withdrawing it again. You will become aware of characteristic sensations arising as a result of tension of the muscles bringing closer (convergence) or separating (divergence) the axes of the eyes. Moreover, this will involve the muscle which alters the convexity of the crystalline lens, i.e., ensures accommodation.

When a hunter looks at the sight of his gun situated 35-40 cm from his eye, the front sight located 80-90 cm from his eye, and the target removed scores and sometimes hundreds of metres, his eyes converge and accommodate. Many hunters assert that they see the sight, front sight and target equally well. How can this be? It turns out that training increases the speed of convergence and accommodation, and retention of the visual image during the momentary shift of the eye from the target to the sight and back again enables the hunter to see these images, as in the cinema, coinciding and, consequently, distinctly.

Similar, although weaker, sensations form part of perception of distances from objects in depth vision. That is why you will hardly succeed in putting the wire through the ring in monocular vision.

Monocular depth vision is helped by the so-called air perspective and the play of light and shadows on visible objects. However, this may also hamper the estimation of distances. Travelers should know the following rules:

- in the mist or haze the objects at the horizon appear farther than they do in good visibility which brings them closer;

- brightly illumined objects, bonfires and flame appear closer as also do things painted white, yellow or red;

- when the sun is ahead of an object the distance to it appears shorter, and when it is behind it—longer than the true distance;

- large objects are seen in closer perspective than are small objects; the distance to objects situated in an even area seems to grow shorter and in a hilly area, on the contrary, longer. That is why the opposite river bank or lake shore always appears closer than it is;

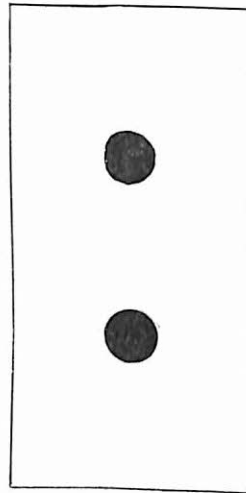
- an object appears more distinct against a light background. That is why a house against the background of the sky appears closer than the same house appears against the background of a mountain or forest.

The effect of the play of light and shadows on perception of depth is well demonstrated by the drawing in which one cross is seen convex and the other concave. Turn the drawing upside down and the convex cross will become concave, and the concave cross will become convex, regardless of whether you look with one or both eyes.

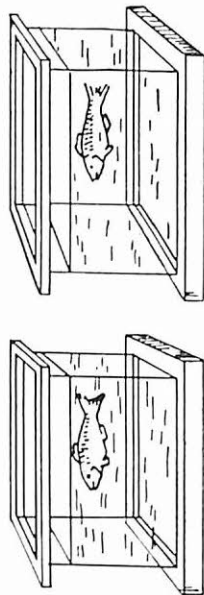
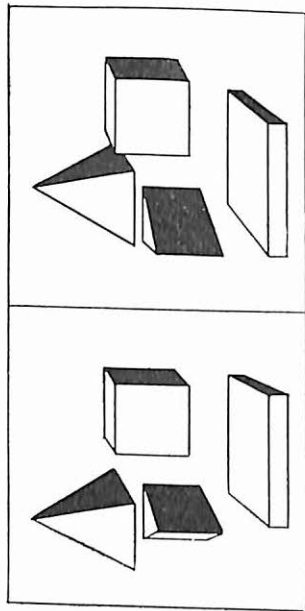
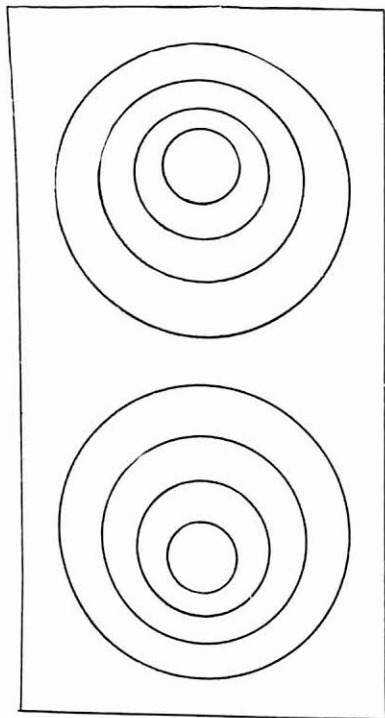
RIDDLE OF THE STEREOSCOPE

If you look out of the window alternately closing your eyes, the visible picture will change. If you photograph this picture, first as it is seen by the right eye and then as it is seen by the left eye, the pictures will somewhat differ. Now, if you insert the photographs in a stereoscope and place it at such a distance that the two images coincide, you will discover that the combined photo has become stereoscopic: the window will be closer than the house seen through it and the flowers on the window sill will be still closer.

An important role in the perception of depth is played by the fact that the reflections of objects situated at different distances fall on so-called disparate points of the retina. When a person looks at some object the axes of his eyes are involuntarily fixed so that the image of the object falls on the central foveae of the retina, i.e., the sites of greatest accumulation of cones.



BY LOOKING "INTO THE DISTANCE"
BETWEEN THESE POINTS IT IS
POSSIBLE TO GET THEM TO
COALESCE



YOU CAN LEARN TO SEE THESE PICTURES AS THREE-DIMENSIONAL
WITHOUT A STEREOSCOPE

Let us imagine retinas superimposed on one another so that their central foveae as well as the vertical and horizontal meridians coincide. In such a case all the coinciding points of both retinas will be identical and the images will be perceived singly and flat. All the other points of the retinas will be non-identical or disparate.

When the disparateness of the images of objects in the two eyes is great, the objects begin to double; when it does not exceed a definite value, a sensation of depth appears. That is why the image will begin to double if the photograph in the stereoscope is placed too far or too near; however, at a distance definite for each person the images merge and produce a clear perception of perspective.

Wheatstone, the inventor of the stereoscope, showed that one can learn to look at stereoscopic images without a stereoscope so that the images merge into one which then becomes three-dimensional. The illustration in this chapter shows several such figures gradually becoming more complex. By looking into the distance between the two spots one may achieve their merging. After learning to do this one may tackle the next pair, etc. The concentric circles will be perceived as a tube receding into the distance and the geometric figures will begin to soar in the air at different distances from each other.

Not everybody can perform this experiment easily because stereoscopic vision is not equally developed in all people, which is also manifest when different people see a stereoscopic film.

LEADING EYE

The coelenterates—the closest common ancestors of man and cephalopods (the octopus and calamary)—have as yet no eyes. However, the eyes of the octopus are constructed almost like those of man. This is one of the manifestations of so-called analogy in the development of organisms, which warrants the assumption that the highly-organised representatives of other planets have a structure similar to that of man.

But the deep-water calamary's (the closest relative of the octopus) left eye is four times as large as its right eye. The calamary apparently uses the left eye in very deep water, and the right eye—on the surface of the ocean.

Both eyes are rarely equal in any person. One of them is usually the leading eye. While looking simultaneously at close and distant objects, close with the palm of your hand first one and then the other eye. The moment you close the leading eye everything will sharply shift to a side, but when you do the same with the other eye the picture will scarcely change.

When working with a microscope and looking into it with the leading eye don't screw up the other eye. But since it is easier to work with a microscope with the left eye, because the right eye is simultaneously used to read or make drawings, the left eye of laboratory technicians usually becomes the leading eye. A hunter whose right eye is the leading eye finds it easier to aim. He does not even have to shut his left eye.

HOW YOU MUST LOOK AT PICTURES

It has long since been noted that pictures and photographs are perceived in greater relief and sometimes stereoscopically when looked at with one eye. The British philosopher Bacon gave it the following naive interpretation as far back as the 16th century: "We see better with one eye than with two because the vital spirits concentrate in one place and act with greater force."

This phenomenon was correctly explained in 1876 by the British psychologist William Carpenter. "The fact is," he wrote, "that when we look with *both* eyes at a picture within a moderate distance, we are forced to recognise it as a flat surface; whilst, when we look with only *one*, our minds are at liberty to be acted on by the suggestions furnished by the perspective, chiaroscuro, etc."

"It is remarkable," he continued, "that the effect of this mode of viewing photographic pictures is not limited to bringing out the solid forms of objects; for other features are thus seen in a manner more true to the reality, and therefore more suggestive of it. This may be noticed especially with regard to the representation of *still* water, which is generally one of the most unsatisfactory parts of a photograph; for although, when looked at with *both* eyes, its surface appears opaque, like white wax, a wonderful depth and transparence are often given to it by viewing it with only *one*. And the same holds good also in regard to the characters of *surfaces* from which light is reflected, as bronze or ivory."

We shall better understand this explanation if we recall that the reflections of images falling from photographs or pictures on identical points of the retina do not produce an impression of depth; the latter will appear if you look at the image with one eye (owing to the air perspective and the play of light and shadows).

The distance at which a photograph or picture must be viewed is also far from immaterial. It is best to look at a photograph from the same angle from which the "eye" of the camera "saw" the photographed objects, i.e., from the focal distance of the objective. This value correspondingly

increases if the photograph was enlarged. For example, a picture made by a regular camera and enlarged to postcard size must be viewed from a distance of about 20 cm.

Pictures, drawings and photographs viewed through a paper or some other tube also win in relief because this way of looking at them eliminates the flat backround (wall, table) against which they are situated.

ILLUSIONS NOTICED BY GOETHE

"A dark object seems smaller than a light one of the same size. If we simultaneously look at a white circle against a black background and a black circle of the same diameter against a white background, the latter appears about one-fifth smaller than the former. If the black circle is made correspondingly larger, the two circles will appear of equal size. The young crescent appears to be part of a circle of a larger diameter than the remaining dark part of the moon which is sometimes also distinguishable. In dark clothes people appear slenderer than they do in light dress. Sources of light seen from behind an edge seem to cut out part of it. A ruler from behind which the flame of a candle appears seems to have a notch at that point. The rising and setting sun seems to make a hollow in the horizon. . . ."

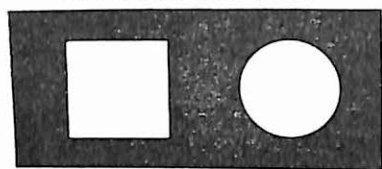
The foregoing is an excerpt from the *Theory of Colours* of the famous German poet and thinker Johann Wolfgang Goethe.

These illusions are due to the optic properties of our eyes and are therefore physiologic illusions. Owing to the so-called spherical aberration* every light contour of an object is surrounded by a light border on the retina. It is this border that enlarges the image. Goethe was wrong in saying that the size of the image decreased one-fifth. The width of the border really remains constant, but the size of the image changes with the distance. The illusion described by Goethe comes more clearly to the fore if the object is viewed from a distance.

The empty space between the lower and each of the upper circles seems larger than the distance between the external edges of the upper circles shown in our illustration. Place the book so that it is well illumined and look at the illustration (p. 98) 5-10 paces away. The illusion will increase.

* A spherical aberration is any disturbance of the rays of a pencil of light such that they can no longer be brought to a sharp focus or form a clear image. — *Auth.*

ESTIMATE AND THEN
CHECK TO SEE



IF THE WHITE AND BLACK
FIGURES ARE OF THE
SAME SIZE



AND HOW MANY SUCH
CIRCLES CAN BE PLACED
BETWEEN THE LOWER AND
ANY OF THE UPPER CIRCLES

SIZE OF THE MOON

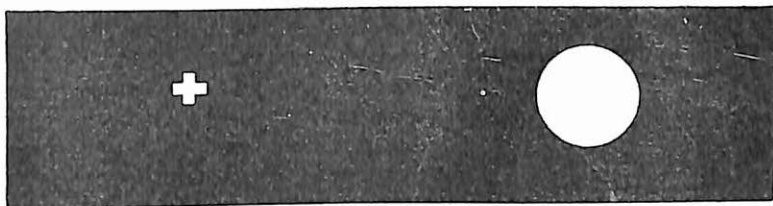
A full moon has risen high over the horizon. Ask your friends what size it is. Some will say it is the size of a watermelon, others—that it is as large as a basin, and still others—that it is no larger than a twopence. It is useless to argue about it because the size of the moon appears different to different people. One of my acquaintances believed the moon to be larger than the crown of the oak on the distant hill behind which it set.

Train a mirror on the moon, and you will easily cover its image with a ten-cent piece if you hold the mirror at arm's length. If you draw the moon on the book you are reading, holding the latter at a distance of 25 cm from your eyes, it will be a little larger than the "O" of the type in which this book is printed.

People have been discussing since Ptolemy's time why the sun and moon appear 2.5-3 times as large at the horizon as in the zenith. Not a single explanation so far given can be considered the only correct one. One thing is clear: it is an illusion that is not registered by optic instruments and does not depend on the structure of the eye. It is a psychological illusion.

BLIND SPOT

"Against a dark background at about the level of my eyes I fastened a small white paper circle and at the same time asked that another circle be held two feet to the right of the first one, but somewhat lower so that its image may fall on the optic nerve of my right eye when I shut my left eye. I took a stand opposite the first circle and gradually receded without taking my right eye off this circle. When



SHUT YOUR LEFT EYE AND FOCUS YOUR RIGHT EYE
ON THE CROSS AT A DISTANCE OF ABOUT 25 CM;
THE WHITE CIRCLE WILL DISAPPEAR

I was about 9 feet away the second circle, which was about 4 inches large, completely disappeared from the field of vision. I could not ascribe this to its side position because I distinguished other objects which were still farther to the side. I would have thought that it had been withdrawn if I didn't find it at the slightest shift of my eyes."

Edme Mariotte (1620-1684) thus described the experiment he performed in 1666. He discovered the blind spot which was given his name. He was the famous physicist (one of the founders and first members of the Paris Academy of Sciences) we all know by the Boyle-Mariotte Law. Mariotte's experiment may be repeated not only in its classic form, but also with the aid of the illustration given in this book.

PICTURE ON THE CEILING

*Whosoever casts eyes on the fast-sinking crimson-hued sun
When on the verge of setting behind the horizon
Thereafter shall see it beyond his will
On the rocks, dark bushes and everywhere else.
Wherever he casts his glance, there shall it be, the same,
Swaying gently and tinged with the brightest of colours.*

When you read these lines of Goethe you probably recall that you, too, have repeatedly had a similar experience. However, this experiment must be performed carefully and at long intervals to avoid straining the eyes with too strong a light.



LOOK AT THIS PICTURE,
THEN TRANSFER YOUR
GAZE TO THE CEILING, AND
YOU WILL SEE A PICTURE
OF LOBACHEVSKY

Try the experiment using the illustration given on this page.

To make your experiment more successful, sit down for a while with your eyes closed. Then look at the illustration for a longer time, say, 20-30 seconds, without taking your eyes off. Now screw up your eyes and quickly look at the ceiling where you will see Lobachevsky's portrait.*

These phenomena are due to trace processes operating in the retina and the cerebral cortex.

Sometimes a positive subsequent image is so vivid and persistent that the person seems to see for a long time what he formerly perceived. This phenomenon is known as eidetic imagery.

The subsequent image usually appears "swaying", as Goethe put it, or soaring in one direction. It occurs for the following reason: While looking at an object, we turn our eyes and head, and thereby include the work of the motor and vestibular analysers in the act of visual perception, whereas on the appearance of the subsequent image this interaction of the analysers is absent, which causes the apparent motion. Turn your head sharply and the picture on the ceiling will cease to sway.

LEONARDO DA VINCI'S ADVICE

"If you, artists, want to derive useful recreation from your games, you must always use things in the interests of your occupation, i.e., so as to impart proper judgement to your eye and learn to estimate the true width and length of objects; to do that, let one of you draw a straight line on the wall, and the rest hold in your hands a thin stalk or straw, and let each cut off a piece of such length as the line appears to him at a distance of 10 cubits; then let each of you walk up to the model to measure by it the size of his own determination, and let the one who comes the closest to the size of the model be the best and the winner, and let him receive from all of you the prize set by you beforehand. It is also well to take

* N. I. Lobachevsky (1792-1856), Russian materialist philosopher, great mathematician, and originator of non-Euclidean geometry.—Ed.

smaller measures, i.e., a dart or walking-stick, and to look at them at some distance, and let each of you try to estimate how many times this measure will fit into the distance. Also, who will best draw a line one cubit long and then measure it with a taut string. Such games impart to the eye a correctness of judgement which is the principal quality in painting”.

This advice of Leonardo da Vinci may be followed with benefit not only by artists, but also by all who want to develop their powers of estimation by sight.

INTEGRITY OF PERCEPTION

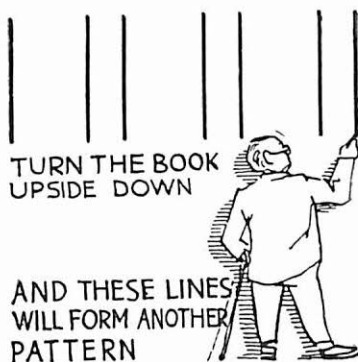
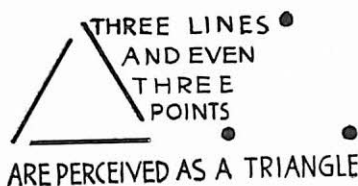
Almost anyone looking at the upper part of this illustration will see two triangles. The fact is that in any perception the image first strikes the eye as a whole and the details become visible later; owing to the integrity of perception the separate lines and points become united in a figure. A number of lines are perceived as a pattern whose character is usually determined by one of its parts which organises the whole, as its first interval does in the lower picture. We are accustomed to reading from left to right. An Arab reading from right to left will see another pattern in this picture.

When listening to music we perceive not a series of sounds, but a melody which remains the same whether played by a symphony or string orchestra, or only a piano. The integrity of the musical image impresses itself in our consciousness more vividly than do the individual auditory sensations differing in the given cases.

When we speak by telephone we do not hear all letters, but this hardly inconveniences anybody. To be sure, we do not pronounce all letters of the words in usual speech either.

This is one of the manifestations of the integrity of perception. Sometimes two or three unfinished phrases are generalised and are perceived as a complete thought. A work of art makes us perceive it actively and creatively, and re-create the whole from its details. It thereby differs from a protocol or a photograph.

OWING TO INTEGRITY OF PERCEPTION



ALTHOUGH THIS PICTURE IS UNFINISHED,



YOU CAN ALREADY TELL WHAT IT IS

"For goodness' sake, Professor," I was interrupted by a young artist during a discussion of this topic. "What you are saying is but a step from abstract painting which is also something like a dotted drawing, a mere hint."

He was wrong. A dotted drawing and a hint in conversation are part of something infallibly real, an already well-known whole, as, for example, the skier in the picture, whereas abstract painting makes it a principle to represent nothing real.

WHIMS OF TASTE

"What a tasteless dinner," a woman at my table in the restaurant said and sneezed.

"The dinner is no worse than usual," I returned. "You merely have a bad cold and do not smell the odours of the courses. And yet odours not only form part of gustatory perceptions, but also determine all of their diversity."

It is precisely because of olfactory sensations that experienced tasters can tell by taste not only the grade of wine and the grapes of which it was made, but also the year of its make.

Our taste sensations are in themselves very poor. We sense only four tastes of various intensity: sweet, sour, bitter and salt. But we find it very difficult to blend them into mixed or intermediate tastes. This may be demonstrated by the following experiment.

Make a saturated solution of sugar in one glass and of salt in another. Put a little of the former on the tip of the tongue (on the left) and some of the latter on the right edge of the tongue. You will alternately be aware of two tastes which will fail to blend into one common, third taste. A while later you may repeat the experiment, this time with lemon juice and a quinine solution. It should be noted that different portions of the tongue perceive taste differently. The tip of the tongue is the most sensitive to sweet, its edges—to sour, and the region of its root—to bitter. Each of these parts of the tongue contains more of the corresponding taste receptors.

Now try the following experiment. Wipe your tongue dry with a clean handkerchief and then rub it with a piece of rock candy and a large crystal of salt. You will feel no taste. You may even put quinine on a dry tongue and you will not become aware of the bitterness until the saliva dissolves the quinine.

SENSE OF TIME

There are people who always know what time it is and who can easily wake up at the requisite time without an alarm clock.

Strike twice at any interval, measuring the time by the second hand of a watch, and different people will tell you with different degrees of precision how many seconds elapsed between the two strikes.

When I told you about analysers I failed to mention the time analyser.

The thing is that, in addition to space, time is one of the basic forms of existence of matter. All our analysers perceive the motion of matter not only in space, but also in time. All biochemical and physiologic processes in the organism also operate in time. Many of them are determined by various rhythms, including daily biological rhythms. Auditory or kinesthetic sensations produce the most precise differentiation of time intervals. Sechenov considered them excellent measurers of small time intervals.

Perception of time is a reflection of objective reality, of the speed and sequence of real phenomena. The time sense is not inborn. It develops as a result of accumulated experience.

I am sure you must have complained about time more than once sometimes because it flies and at other times because it seems to drag on. To be sure time neither "flies" nor "drags on"; it is our evaluation of it that changes.

The hours, days and even weeks filled with significant and interesting events appear fleeting and short, whereas a length of time during which nothing in particular happens and everything is humdrum, habitual and monotonous seems especially long. As a rule, we underestimate the time of pleasure and joy, and overestimate the time of trouble and boredom. The period of time during which there is a lot to be done always seems the shortest.

All this can be explained physiologically. When processes of excitation predominate in the cerebral cortex and, consequently, metabolism is increased, time runs "faster". During predominance of inhibition it drags "slowly".

We are now referring to a direct evaluation of time intervals. But, if we evaluate them by recollections, the picture changes: the past time intervals saturated with various interesting events which we remember in detail are evaluated by us as longer than the periods about which there is actually nothing to recall.

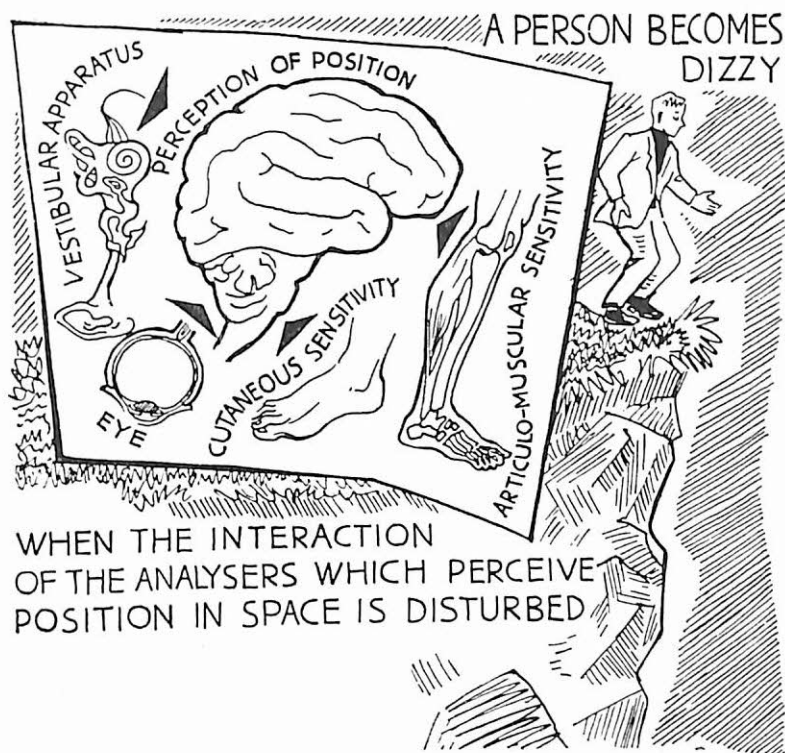
When a shorter-than-five-minute period is recalled it usually seems longer than its actual duration; the most precisely evaluated are 5-15-minute intervals; longer periods of time are recalled as if they were shorter. This circumstance is always taken into consideration by law officers when they interrogate witnesses.

FLOATING BRIDGE

When you look into the distance from the height of the 20th storey you do not get dizzy, but the moment you look down you begin to feel giddy. The latter is due to a disturbance in the usual, normal interaction of the various analysers—the vestibular apparatus, which signals about the vertical position of the body, and vision, which usually perceives the plane of the earth as horizontal.

A Chinese proverb says: "Look through the railing of a bridge and you will see the bridge float on motionless water." The moon similarly appears running past motionless clouds. It is difficult to tell at once whether it is our train that has started moving or the one we see through the window on the adjacent track.

All these examples are also interesting for the following: You rarely feel giddy when standing on the stern of a ship and watching the water running back. But stop in the middle of a bridge, look down upon the



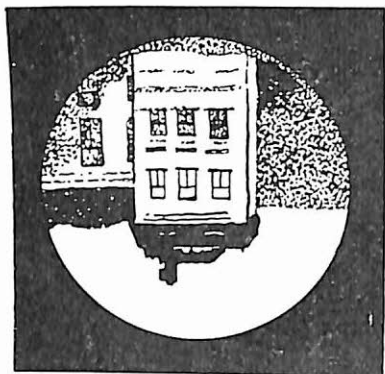
running water, and you get dizzy and perhaps even nauseated. It means that in this case the normal interaction between the visual and vestibular analysers has been disturbed, whereas, while you were moving with the ship, this interaction was retained.

UPSIDE DOWN

You probably know that our eyes are like cameras and that the retina shows the images of visible objects upside down. This is demonstrated, in particular, not only by the laws of optics of the eye, but also by direct experiments. If the eye of an instantly killed dog is very quickly and appropriately treated, the retina will show an upside-down image of what the dog saw at the moment of death and black-out of the eye.

It should be noted, however, that these laboratory experiments are only of theoretical importance and rarely succeed. All rumours to the effect that

"DEVELOPED" RETINA OF THE DOG'S EYE



WITH AN UPSIDE DOWN
IMAGE OF WHAT THE DOG
SAW AT THE MOMENT OF
DEATH

a similar phenomenon may be discovered in the eye of an assassinated human being and that it may help to find the assassin are nonsense.

But why don't we see everything upside down then?

We don't see anything upside down because integral perception is stronger than separate sensations. Experience tells the child from his very first days which is up and which is down. It is well known, however, that people, formerly blind and obtaining vision as a result of an operation, for some time really see everything upside down.

The Austrian psychologist Frismann wore for several days spectacles with prismatic lenses which turned the images upside down. He took them off only when going to sleep and only in total darkness at that. For a while he saw everything upside down, but soon everything was "all right" again. He

not only began to see things as usual, but was even able to ride a bicycle while wearing these spectacles. But when he took the spectacles off he saw everything for a while upside down again.

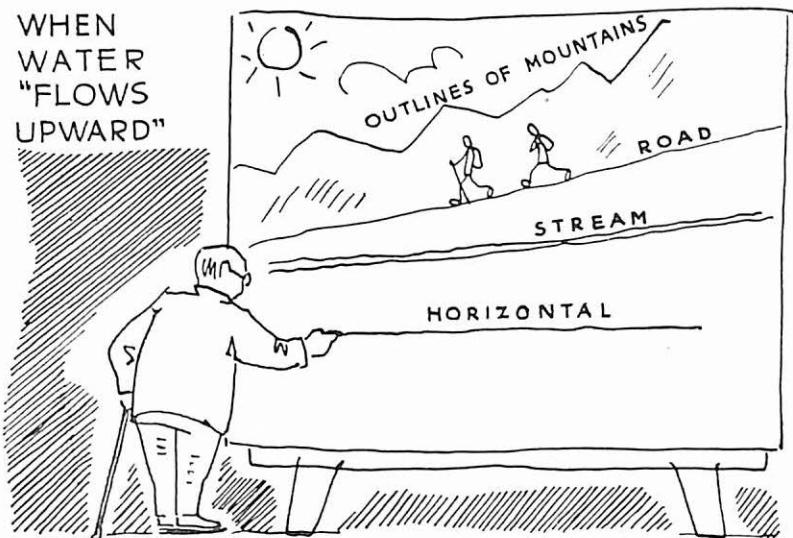
The scientist repeated this experiment with the same results in spectacles producing a mirror reflection. The interesting thing is that for some time after he put on and took off either of the spectacles the disturbed interaction of the visual, vestibular and kinesthetic analysers made him giddy, caused nausea and even vomiting.

WHEN WATER FLOWS UPWARD

"During my hikes through the Caucasus and the Crimea," a lady tourist told me, "I was surprised time and again how clearly a stream or river running along the road seemed to flow upward rather than downward. How do you explain that?"

"This happens when the incline of the road is greater than that of the stream- or river-bed. Look here," I said and drew a little diagram which is reproduced in the illustration.

WHEN
WATER
"FLOWS
UPWARD"



Such an illusion also appears when the entire valley descends more steeply than do the road and stream by its side. This illusion may also be produced by the outlines of the ridges which enclose the valley.

This phenomenon gave me a lot of trouble when I drove through the Caucasus. For example, on seeing that the road ran downward I would turn the engine off in order to save fuel, but my car would stop. In Terskol, near Mt. Elbrus, we fussed a good deal with the engine and ignition since, as it seemed to us, the car had great difficulty climbing even the slightest upgrades. Only on our way back did it occur to us that we had been unfair to the car; the upgrades had been slight only in regard to the steeply rising Baksan Canyon.

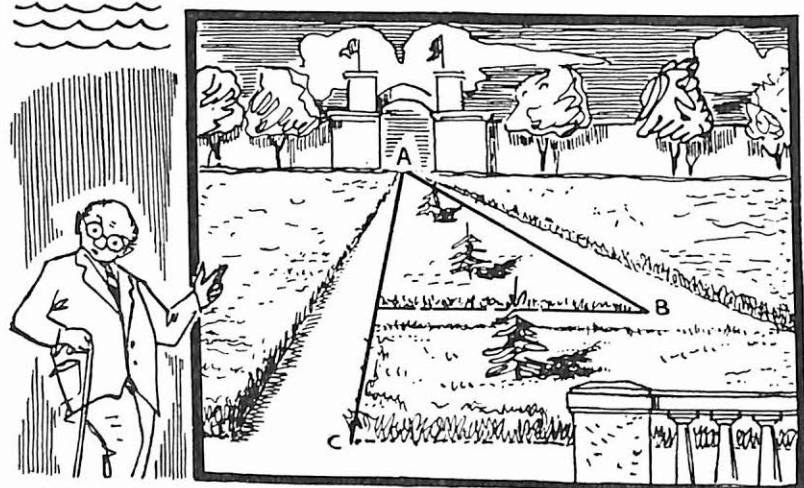
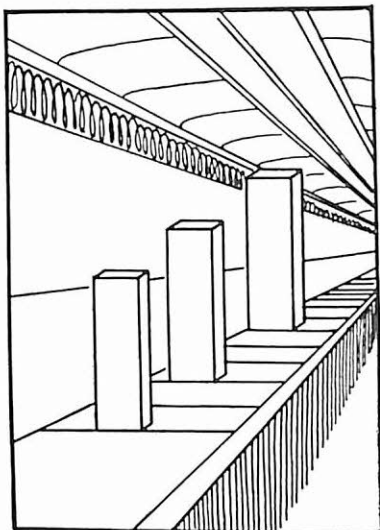
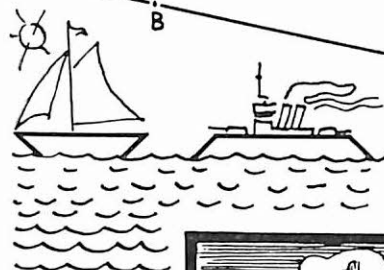
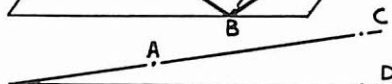
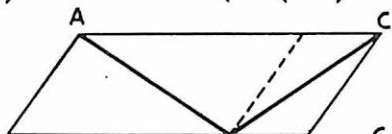
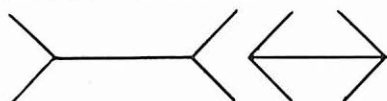
ERRORS OF EVALUATION

*Our eyes are unable, my friend, to decipher the meaning
of objects,
Therefore do not ascribe the errors of reason to them.*

These just words are quoted from the didactic poem *On the Nature of Things* (*De Rerum Natura*) written by the Roman poet Lucretius more than 2,000 years ago.

COMPARE THESE LINES AND FIGURES

MÜLLER-LYER'S ILLUSION



YOUR MISTAKES IN ESTIMATION ARE DUE TO
THE INTEGRITY OF PERCEPTION

"Our senses do not deceive us, not because they always judge correctly, but because they do not judge at all," said Kant about 200 years ago.

But the errors of judgement are often due to the integrity of perception and are caused by the fact that the evaluation of an object as a whole influences the evaluation of its parts.

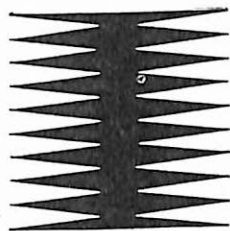
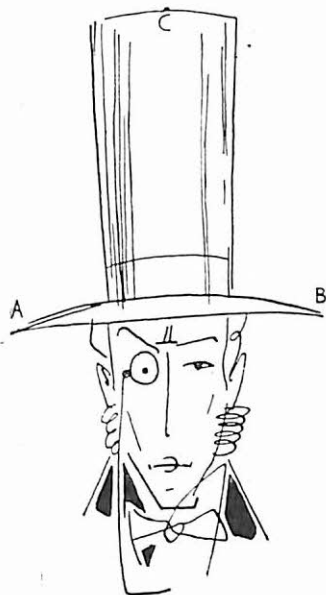
Last century the German psychologist Müller-Lyer for the first time described the illusion shown on the preceding page; the illusion was subsequently given his name.

The diagonal AB of the larger parallelogram appears longer than the diagonal BC of the smaller one. Distance AB seems longer than distance CD. The deck of the steamer on the right looks longer than that of the sailboat on the left. The more integrated the image, the clearer the illusion of evaluation. That is why the clearest illusion of evaluation is that of line AB as taking up only part of the path.

Owing to the law of perspective a tree, cliff, building, factory chimney or any object in general is perceived as of lesser height than it actually is. The corrections which we are in the habit of making lead to re-evaluation of the length of vertical lines compared with that of horizontal lines. This illusion is so stable that it has to be taken into consideration in manufacturing type. It is also taken into account by architects in designing building decorations.

We believe that figures 3 and 8 and letters B and K consist of two equal halves only because their upper parts are smaller than their lower parts, which can be easily ascertained by turning the book upside down.

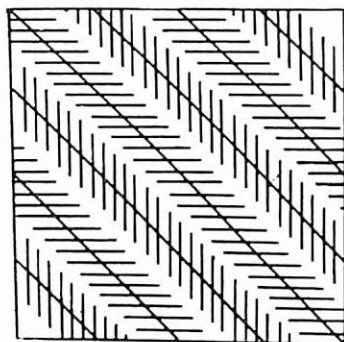
Women know that in vertically-striped dresses they look taller and in horizontally-striped dresses—stouter. It follows that illusions may also be helpful. Leonhard Euler (1707-1783), great physicist and member of the St. Peters-



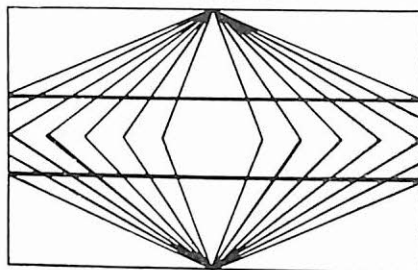
ILLUSION
OF HEIGHT AND WIDTH

ILLUSIONS OF DISPLACEMENT. IT IS HARD

ALL THESE LINES ARE PARALLEL

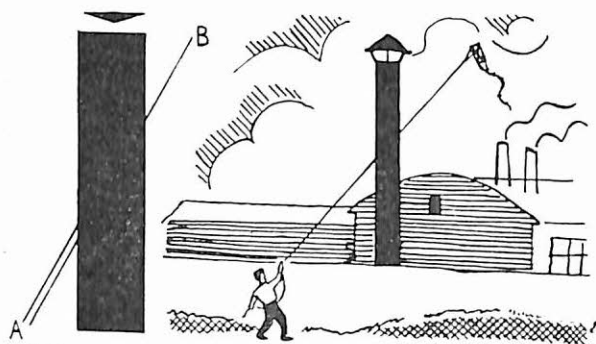


ZÖLLNER'S ILLUSION



GÖRLING'S ILLUSION

LINE A B
IS STRAIGHT



POGGENDORFF'S ILLUSION DISAPPEARS IN
INTEGRAL PERCEPTION

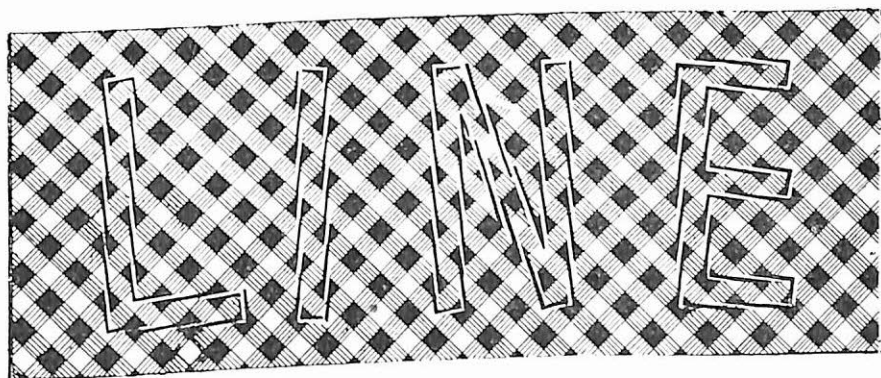
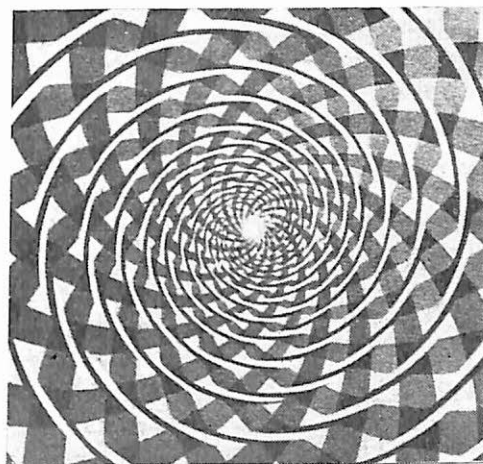


burg, Berlin and Paris Academies of Sciences and of the British Royal Society, wrote as follows about it: "All of artistic painting is based on this deceptiveness. If we were in the habit of judging about things by truth, this art (i.e., painting) could not exist even as though we were blind. An artist would vainly exhaust all his skill in mixing colours because we would say: here is a red spot, there is a blue one, and there we see a black spot and several whitish lines; everything is on one surface and we can see neither distances nor differences. Nor would it have been possible to represent a single object. Whatever were painted on the picture would

TO BELIEVE THAT
THESE ARE CONCENTRIC CIRCLES



AND THESE LETTERS
STAND STRAIGHT



seem like writing on paper. Wouldn't it be a pity if despite the perfection of our senses we were deprived of the great pleasures and benefits we get from the art of painting?"

ILLUSIONS OF DISPLACEMENT

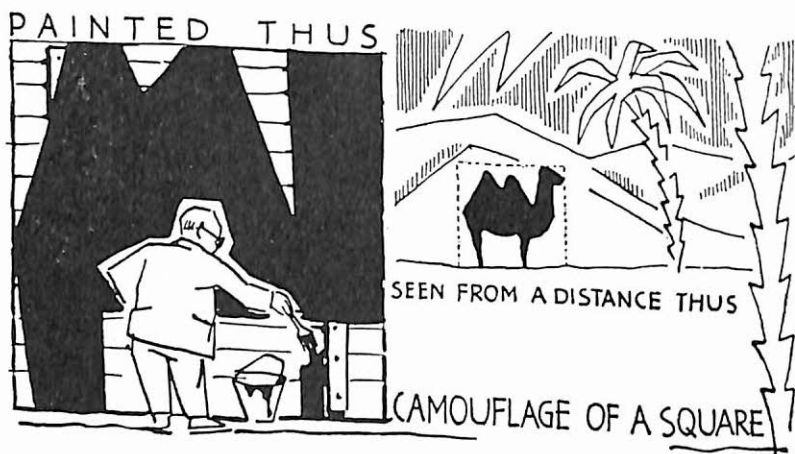
Some illusions disappear or noticeably diminish after a check-up, but deceptive perceptions may also be very stable. These include particularly the illusions of displacement in perception of intersecting lines and angles.

Instructive in this respect is the illustration shown at the bottom of this page. It proves that the integrity of perception is stronger than the illusion of displacement because the latter disappears.

CAMOUFLAGE

The laws governing visual illusions are used particularly in camouflage.

There are different types of camouflage colouring. Protective colouration may be monochromatic—green in summer and white in winter; it makes objects unnoticeable, blends them with the background. Deforming colouration alters the shape of objects. If a light box is partly painted dark, it



will appear from a distance as a dark, irregularly-shaped spot or will be perceived as some other object.

Camouflage robes are covered with dark and light spots. Warships are covered with geometrically regular spots so that the optic illusions thus created may hinder observers from determining the ships' course.

BY CONTRAST

"I don't like to dance with you. You are so tall that I look even shorter than I am, just like a shrimp," said she.

"That's foolish," he muttered offended.

And yet she was right, which can be easily ascertained with the aid of the illustration shown on p. 113 and the following experiments.

Pour water into three glasses and put half a teaspoonful of salt into one of them. Ask somebody to taste fresh water from the first glass, then salt water from the second glass, and then fresh water again from the third glass. The water of the third glass will be appraised as especially fresh and tasty, whereas the water from the first glass will seem merely tasteless. This experiment may be tried even on oneself, in which case two glasses of water—one with fresh and one with salt water—will suffice.

But the illusion of contrast may be tested with particular clarity by the following experiment. Put three deep plates on the table and pour cold water into the plate on the right, hot water (about 40°C) into the plate on the left, and half-and-half into the middle plate. Immerse one hand in the plate on the right and the other hand in the plate on the left, and after holding them there for a few minutes transfer both hands simultaneously into the middle plate. The same water will be hot for the right hand and cold for the left hand.

Knowledge of the law of contrasts enabled me during the Great Patriotic War to help several navigators to avoid trouble.

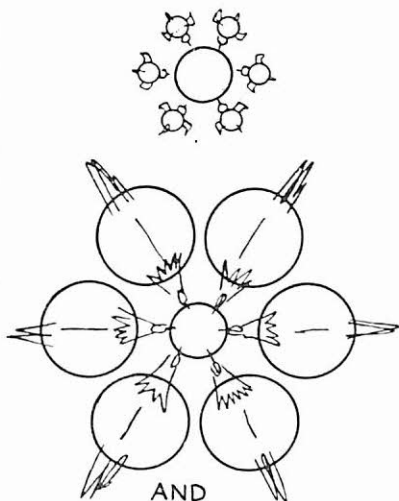
The crew of a bombing-plane reported on the basis of a visual estimation that they had blown up either a depot or a lorry or a goods van loaded with ammunition. The photo-records of the bombing failed to confirm the report. The men were suspected of lying.

It turned out, however, that the crew had theretofore used heavy bombs and had learned to estimate their explosions by sight. But when the plane was loaded with one heavy and several small bombs

BY CONTRAST THE BOY
ON THE RIGHT



APPEARS DARKER



AND
THE UPPER FEEDER
LARGER

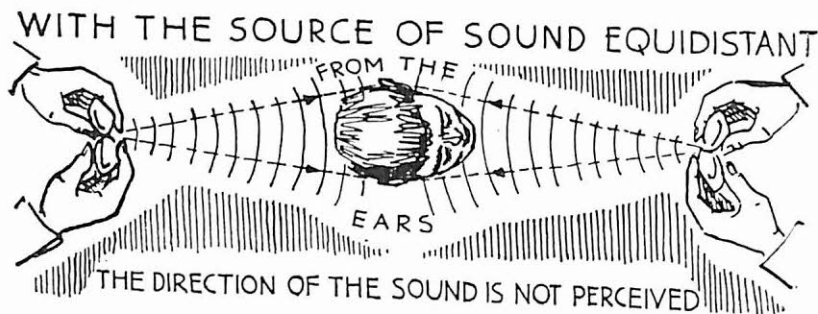
the explosion of the heavy bomb against the background of the small ones seemed by contrast much greater than ever before and was appraised as an explosion of ammunition. A questioning of other navigators confirmed the legitimacy of such illusions.

WHERE IS THE GRASSHOPPER?

Is there anyone among you, Dear Readers, who has not tried to catch a loudly chirring grasshopper and failed? No sooner do you steal up to it than you hear it chirring at some other place.

To be sure, it isn't at all like that. The grasshopper has not changed places, but it is you who have incorrectly judged the direction of the chirring. If you take such a stand as to hear the grasshopper not in front of you, but from a side, and then go in the direction of the chirring without turning your head, you will have no difficulty catching it.

But since you don't always have grasshoppers ready to hand I'll ask you to do the following experiment to prove my contention.



Ask a friend of yours to shut his eyes, then strike with some two objects, say, two stones, at unequal distances from his head, but always strictly in front or in back in a plane running through the axis of his head, in other words, always at equal distances from both the right and left ears. I bet neither your friend nor anyone else, for that matter, will be able correctly to determine the direction of the sound. The sound will appear "to jump like the grasshopper". But, if you strike the stone from a side of the head, there will be no errors, and anyone will easily tell where the sound comes from.

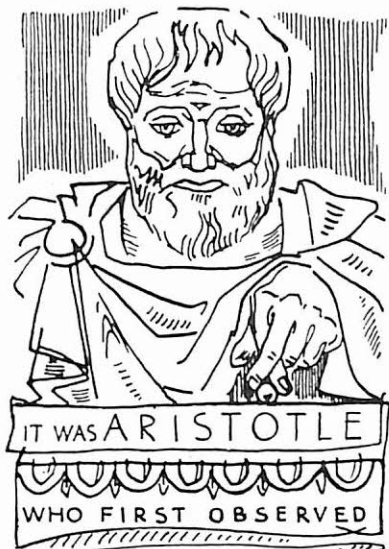
That is why, when listening, we involuntarily turn our heads so that the sound may come from a side.

TWO OR ONE?

The following illusion was described by Aristotle about 2,300 years ago.

Close your eyes and roll a small ball (preferably a cold, metal ball) with your crossed index and middle fingers, as shown in the illustration. You will feel as though you are rolling two balls. The whole thing is quite simple; the surfaces of the two fingers practically never simultaneously touch one surface, and the sensations issuing from them are therefore not generalised. Sometimes you labour under the same illusion, trying similarly to touch the tip of your own nose; you get the impression that you have two noses.

But if you touch the back of the hand with both compass legs less than 20-25 mm apart you will feel only one touch. On the tips of the fingers you will clearly feel two contacts even if you bring the two compass legs to within 1-2 mm of one another. And if you touch the skin of the back with a compass you will feel two tips only if the compass legs are more than 60-70 mm apart. This is due to the fact that the nerve endings which sense touch are unequally dense. But for the experiment to succeed the compass legs must not contact the hair of the skin.



THAT THIS WAY ONE FEELS
AS THOUGH THERE ARE
TWO BALLS

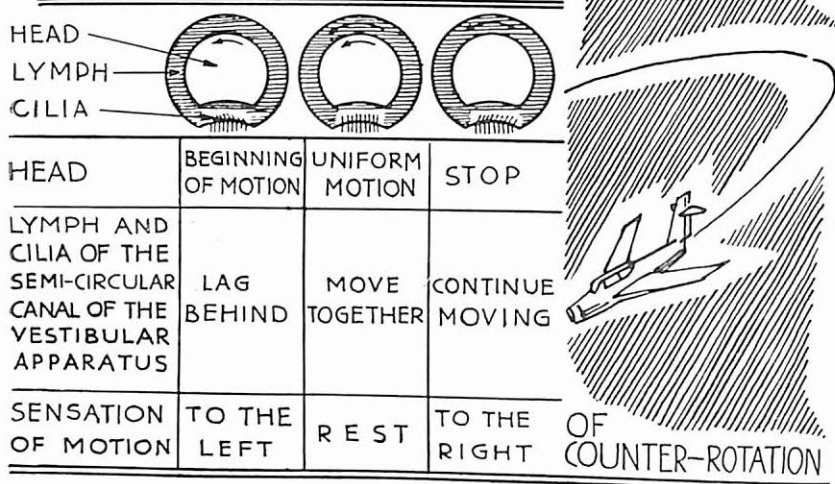
IN FLIGHT

The practical importance of illusions has been best studied in flight. During his first flights it seems to the flying student that his plane is motionless and that it is the earth and sky that spin, as we sometimes see it in the cinema.

A weakening of the wind increases the plane's speed in landing and, consequently, the speed of flashing of the earth with the result that the student does not correctly determine the distance from the earth and unexpectedly, ahead of time, strikes the ground with the wheels. Many such examples can be cited.

But the illusions are particularly pronounced when a flyer flies in the

DIAGRAM OF THE DEVELOPMENT OF THE ILLUSION



clouds and does not see either the horizon or the earth, i.e., in so-called bling flying. These are sensations of counter-rotation, false list and flight as though with the wheels up. The flyers who poorly read their instruments have particularly strong illusions.

Something similar may be produced in a person spun with eyes shut in a special chair. The mechanism of such illusions is associated with the movement of the fluid (so-called endolymph) which fills the membranous labyrinth of the ear. This is shown in the illustration. You may produce the illusion of counter-rotation in yourself if you spin about ten times with your eyes shut and suddenly stop. You will have a feeling that you have begun spinning in the opposite direction.

FIGURE AND BACKGROUND

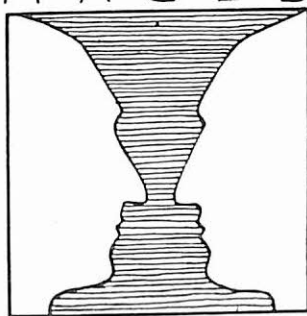
The following answer apparently suggests itself to the question presented by the illustration shown at the top of p. 117.

"It's either a vase or two profiles, depending upon what you are looking at."

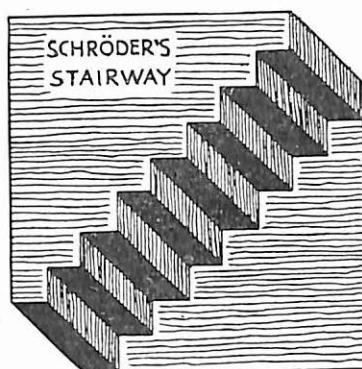
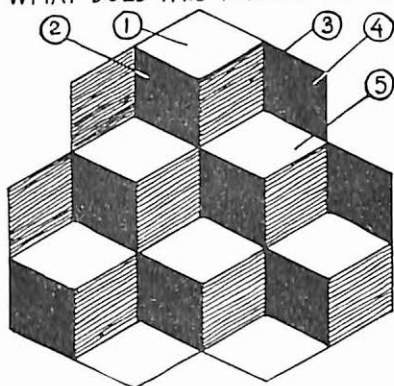
But a psychologist would say, "It all depends on what you call the figure and what the background."

In our comprehension of the figure and background one more quality of perception—its selectivity—manifests itself. In our perception we usually set apart one or several objects, all the rest becoming the background. This

DOUBLE IMAGES



WHAT DOES THIS PICTURE SHOW?



HOW MANY CUBES DO YOU SEE?



WHERE IS THE TRAINER
OF THIS TIGER?



IS THIS WOMAN
YOUNG OR OLD?

is particularly clearly observed in so-called double images which may be seen both as "this and that", depending on the interpretation given to them.

Devoting your attention to the image of a young woman half turned away you may not at once notice in the same picture the old woman with a big nose and chin buried in the fur collar. If you see an ear in the centre of the picture, you will see a young woman, but, if you see an eye, you will discern the image of an old woman. Form a cube from sides 1, 2 and 3 and you will have 6 cubes; take sides 3, 4 and 5 and you will get 7 cubes.

Schröder's stairs are even not a double, but a triple image. If you look at it from the left lower corner diagonally upward, you will see stairs. If you view it from the right upper corner diagonally downward, you will behold a hanging cornice. But, if you run your eyes over the image diagonally from left to right and back, you will discover a strip of pleated grey paper.

At the left lower corner of the page there is a puzzle picture. Look at it closely, then from a distance, and lastly through a magnifying glass. As long as you don't know where the trainer is you will perceive the lines with which he was drawn by the artist as the background. But the moment you have discerned him, try as you will, you can no longer fail to see his face.

Moreover, put the picture away, then look at it again after a while, and you will again see the trainer more clearly than anything else. He will become the main object of your attention—the "figure", while the rest of the picture will become the "background".

This example is also of more general importance since it shows the difference between the technique of perception and the comprehension of that which is perceived. Besides, it shows that perception is always selective and depends on apperception. What this is you will learn from the next few paragraphs.

APPERCEPTION

This concept implies consciousness of the relation of new events, situations, or sensations to past experience, to the mass of concepts already in the mind. Apperception may not only ensure selectivity of perception, but may also lead to illusions. Such an illusion is described by A. S. Pushkin in his poem *Vampire*.

*Poor old Vanya was no hero.
Once upon a pitch-dark night
Home he stumbled through a graveyard,
Pale and shivering with fright.*

*Hardly breathing, wretched fellow,
 In among the graves he stole.
 All at once his face went yellow,
 "Someone's there, upon my soul!"
 Growling, gnawing bones and gobbling—
 There it squatted in the gloom.
 "Dearie, what if it's a goblin!"
 Vanya hid behind a tomb.
 "I'm no match for such a devil!
 He will finish me, I'll swear,
 If I don't chew up some gravel
 From a grave and say my prayer."
 But instead of any goblin
 (Just imagine Vanya's shock!)
 What the coward saw there gobbling
 Was an ordinary dog!*

As in this case, many superstitions are due to the apperception developed in the believers by the church, and the character in Pushkin's poem was such a believer.

The perception of the song of the nightingale, one of the characters in the fable of the famous Russian fabulist Ivan Andreyevich Krylov (1769-1844) was also determined by the donkey's corresponding apperception.

*The singer finished and the donkey made a bow.
 "Hee-Haw!" he chortled, "Not so bad!
 I could have stood another bit of that.
 But really, it's a pity you don't know
 Our Rooster, though:
 He'd show you the direction
 Towards perfection!"*

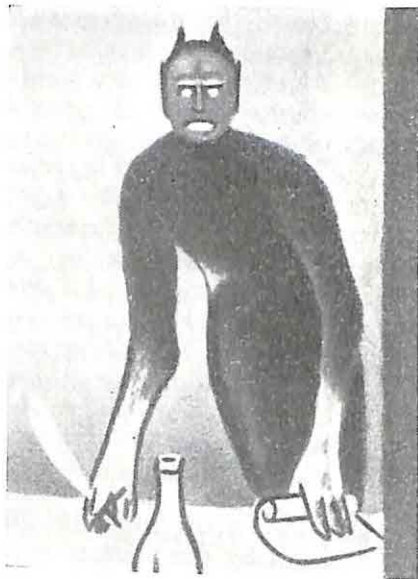
Cervantes gives a vivid description of Don Quixote's perceptions distorted by his apperception.

HALLUCINATION

"Last night I had a hallucination; it scared me so much that I hardly slept all night," one of my patients told me. "I walked into the room and saw someone standing in the moonlight. I wondered who it could be. I walked over and saw it was my dressing-gown and above it a hat hanging on the wall. It frightened me very much, for it occurred to me that since I had a hallucination I must be severely ill."



THE DEVILS WHO DON'T LET ME
GET INTO THE HOUSE



CONTRACTING FOR
THE SALE OF MY SOUL

HALLUCINATIONS

(PICTURES DRAWN BY DIPSO MANIACS)

And yet there was nothing to be scared about. That was not a hallucination, but an illusion, i.e., an incorrect, distorted perception of a real object. In this case a dressing-gown and hat looked like a human figure.

Illusions may be:

physical (a spoon in a glass of tea appears broken even in a photograph);
physiologic (for example, illusions of counter-rotation, temperature contrast);

psychologic (for example, those determined by integrity of perception).

A hallucination is something else. It is a morbid or, as it is referred to, a pathopsychologic symptom. Victor Khrisanfovich Kandinsky, an outstanding Russian psychiatrist and author of the first classic investigation of this phenomenon, gave the following definition of hallucination in 1880: "Hallucination is a sensuous image which does not depend on external impressions, but which at the same time appears real to the hallucinating person."

During a hallucination man does not perceive anything, for it is a trace of former perceptions, a morbid idea arising in his consciousness. Hallu-

cination is a waking-dream. It seems to the person that he sees or hears something that is not, that he can smell an absent odour and even feel contact. Usually he continues to see with his eyes shut and to hear with his ears stopped up.

Sometimes patients record their own hallucinations.

Hallucinations are whimsically woven into the works of some artists who were mentally ill. But, if the recorded hallucinations of really talented artists may become works of art, it does not in any way justify abstractionists in making any work of art look like a hallucination.

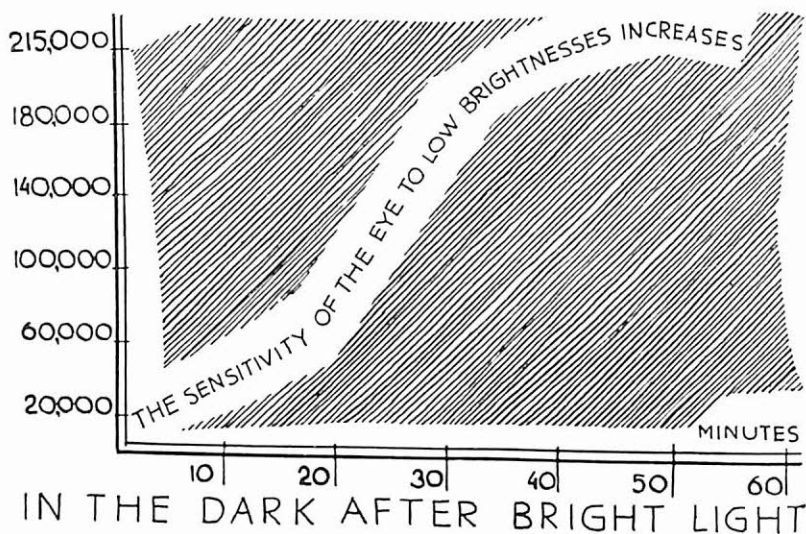
NIGHT CYCLING

"When I ride my bicycle without a headlight at night I have a constant feeling that the road I am travelling is inferior to the one running next to it, and I continuously want to switch over to it. Am I the only one who feels that or does everybody feel this way?" my fellow-traveller asked me as we were returning from a ride in the dark.

"No, it's not only you who feel that way, although not everybody may have been aware of it. It gave me, too, a lot of trouble when I was young, but one day I found out what it was. Do you want to know what it is? Then listen."

The apparatus of diurnal vision consists of the retinal nerve endings, the so-called cones of which the eye has close to seven million. Most of





them are in the fovea centralis. While looking at some object or, say, the road as we ride a bicycle, we involuntarily fix our eyes so that the image of what we are looking at should fall on these foveae. The cones are also organs of colour vision. When the illumination is below 0.01 lux the work of the cones is taken over by the rods (other nerve endings). When the illumination is from 0.01 lux (the light of the moon hiding behind thin clouds) to 33 lucas (illumination on a cloudy day) both the cones and rods are functioning. On a light moonlit night the illumination of the road is about 0.25 lux, while on a moonless but starry night it is about 0.003 lux.

The retina has many more rods than cones—about 130 million. They are located closer to the periphery of the retina. Most of them are at a distance of 12° from the fovea centralis. Hence the result that at twilight you can really see better not the part of the road at which you are looking, but a spot about 12° to the side of it, and that is why that road seems better.

The rods do not perceive colour, and in twilight all colours fade. Hence the saying: "When the candles are out all cats are grey."

"In other words, when you ride a bicycle at twilight it is best to look not directly at the road, but at an angle of 12° ?" my companion asked.

"I won't insist on it," I answered. "We usually attend to what we are looking at. The object whose image falls on the fovea centralis in the retina is perceived as a figure and all the rest as the background. Try carefully to watch the second hand on a timepiece at the same time fixing

your eyes on the figure '12'. This will not be easy and you will involuntarily shift your eyes to the hand."

I advised my companion to do what I myself did when I had already learned a good deal about psychology. In the dark it is best always to scan the road by shifting the eyes pendulum-fashion about 15° to both sides. The eyes of a cyclist sitting normally in the saddle are about 1.5 m from the ground and, if he is to see 2-3 m ahead of him, it is best to hold in the field of vision a strip of road 130-180 cm wide. In this case he will use the peripheral nocturnal vision, and the illusion under consideration will disappear.

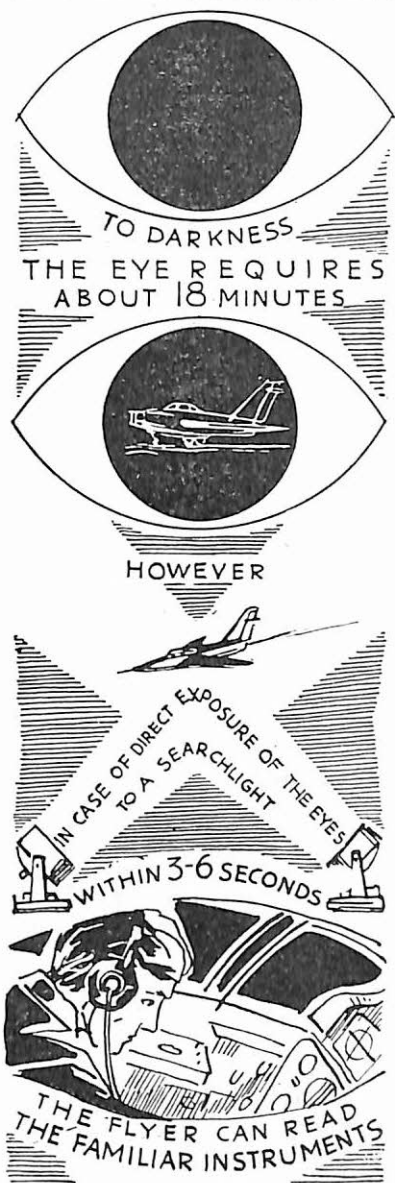
"We learned about the rods and cones in school," said my companion, "but I cannot for the life of me remember which of them is the organ of diurnal vision and which of nocturnal vision."

"Suppose you remember it this way: at night it is easier to walk with a rod."

200,000 TIMES BETTER

We all know that when we enter a dark room we don't see anything at first, but after a while we begin to see things. But do you know that the process of adaptation of the visual analyser to darkness, so-called dark adaptation, operates unevenly, about the way it is shown in the illustration, and continues for many hours and even days? Within but one hour the eye may become 200,000 times as sensitive as initially. That is why roentgenologists, night flyers, scouts and all people who have to work in the dark protect their eyes from needless exposure to light.

FOR GOOD ADAPTATION



Nocturnal vision becomes more acute after preliminary wearing of red spectacles or staying in a room illumined by a red light. Lack of vitamin A in the food sharply impairs nocturnal vision and sometimes even leads to a disease called "night blindness". Large amounts of vitamin A are found in fish liver oil, liver, carrots, cabbage, butter and milk.

Adaptation may not only increase, but also decrease the sensitivity of the analyser. For example, after scenting ourselves with the most stable perfume we soon almost cease to smell it and at times perfume ourselves again thereby eliciting smiles from those around us who have not yet adapted themselves to our excessive fragrance.

HAND SEES LIGHT

A person is sitting at an apparatus which looks like a box and in which his hand is inserted. From time to time and at various intervals a beam of green light falls on the palm of the hand through an opening in the box. All measures have been taken (by means of filters) that this should not be a ray of heat and that all possible additional stimuli—sounds, vibrations, etc.—acting simultaneously with the light should be excluded.

Will this person sense light with the palm of his hand?

Of course, he will not. That much is clear to anybody. But science sometimes requires a check-up on and ascertainment of seemingly indubitable things.

The well-known Soviet psychologist Alexei Nikolayevich Leontyev checked up on it in a special installation resembling the one described above and made sure that man does not really sense light with the palm of his hand. To have still better proof of it, he tried to elaborate a conditioned reflex to the action of light on the palm. Immediately after exposing their palms to light, of which the subjects were not aware, they were given an electric shock in the finger that lay on a push button. But even after 350-400 such combinations no one jerked the finger away on exposure of the palm to light. No conditioned reflex was elaborated. These experiments once more attested that man was not aware of exposure to light.

But can a person learn to sense light with the palm of the hand? Can a new sense organ be created in man?

"Of course, not," you hasten to say. Leontyev likewise could not answer the question affirmatively. But resting on theoretical considerations about the origin of mentality he thought it could be done. This required setting up experimental conditions which favour development of the sense organs of animals. In science the course from assumption to affirmation runs through experiment, and Leontyev proved his assumption by experiments.

To teach a person to sense a ray of light required a mere alteration of

the experimental conditions, very slightly in form, but fundamentally in essence. It was enough to tell the subjects that each time the electric shock would be preceded by something acting on the palm of the hand. Although they were not told precisely what would act on the palm, they now did not merely await a slight discomfort from the light electric shock, but made attempts to prevent it. When they thought that something signalled the coming electric shock they withdrew their fingers. In animals, too, sensations arise on the basis only of such stimuli which orient the organism in its environment, thereby performing a signalling function.

After 30-40 such exercises—now performed actively—all the subjects began almost unerringly to sense light with the palm of the hand and to withdraw the finger from the key in response to its action. This was a new sensation hardly differentiated and barely definable. "Like a touch of a bird's wing", "like a breeze", were the words in which those who were subjected to the experiment tried to characterise it. Although still poorly, the hand already sensed light. This was but a beginning of research in an entirely new field of psychology. It confirmed the old truth that there are no limits to science.

READING WITHOUT EYESIGHT

The preceding story was published in the first edition of the book in May 1962. Six months later, 22 years after A. N. Leontyev's experiments, the newspapers carried the following report:

Rosa Kuleshova, a 22-year-old girl from Nizhny Tagil, was blindfolded, but passing her fingers over the print she continued freely to read a newspaper. She was given a photograph and again without seeing it she was able to tell with the aid of her fingers who was on it and to describe the person's pose and appearance. Coloured pictures were covered with glass, cellophane and thin paper, but Rosa ran her fingers over them and named the colours.

From a closed bag Rosa unerringly extracted skeins of thread of definite colours or requisite playing cards. By touch she could even tell the picture on a postage stamp, and on one photograph she recognised a woman by her... ear-rings.

The report quickly spread all over the world, exciting wonder and incredulity.

Vision at the tips of the fingers?

From the town in the Urals Rosa came to Moscow for a special investigation which was carried out by some of the country's most prominent scientists with the result that everything was confirmed.

Precise experiments rejected the hypothesis of increased tactility and



READING A NEWSPAPER WITH HER FINGERS

were followed by rejection of the hypothesis of increased heat sensitivity. The possibility of mental suggestion of correct answers was also eliminated. It was established that Rosa perceives (precisely, perceives) light and colour with her fingers. She has a cutaneo-optic sense.

Soon it turned out that not only Rosa Kuleshova is able to discriminate colours with her fingers. Some people can learn to do it sooner and better, others—more slowly and not so well. Now that I am writing these lines quite a few people are already being taught to do it. Abram

Semyonovich Novomeisky who had formerly worked with Rosa started experimenting with students of the Nizhny Tagil Secondary Art School and found that on the average one of every six of them could quite easily learn to discriminate colours by touch.

On investigating people with impaired vision and the blind, Iosif Moiseyevich Goldberg, neuropathologist (he was the first to examine Rosa) has found that those who are blind because of injury to the eyes are able to discriminate colours with their fingers, whereas those with disturbances in the visual area of the brain are not.

A. S. Novomeisky gave a person who had lost his vision seven years previously a sheet of silver-coloured paper. The latter passed his fingers over the surface and said:

"It is something whitish, like grey. No, it is the colour of metal: it is steel-blue."

He was then given a piece of cherry-red paper about which he said:

"This is something close to red. It's cherry-coloured; it's the colour of unripe cherries."

But what is still more amazing is that he can discriminate the colour of paper without touching it, by holding his palm up to one metre away from it.

In November 1963 I chanced to meet Lena Bliznova, a 9-year-old very capable pupil of a Kharkov music school, and to carry out several experiments with her. Completely guaranteeing elimination of telepathy these experiments not only confirmed that Lena had this still mysterious ability, which nobody had developed in her, but also showed that she had it to an even greater extent than the other formerly investigated people.

But maybe you, too, have this ability?

Test yourself and others with increasingly complicated problems which Lena solved quickly, easily and exactly. Blindfold yourself; to eliminate any possibility of telepathy, the "controller" must stand behind you and see only the results.

Place "by touch" in two piles mixed black and white checkers or chessmen.

Picking beforehand the aces and sixes from a deck of cards, sort them out "by touch" into red and black.

Read each of these cards with your fingers.

Read the heading of an article in an as yet unread newspaper.

Drawing a black line on a sheet of white paper drop a finger on this line by passing your hand over the paper without touching it.

Nobody knows as yet how often this ability occurs.

What is it? Rudimentary sensitivity formerly inherent in man's ancestors or a new ability which all people can develop? Nobody can tell. But that this sensitivity can be developed has already been demonstrated.

What is the nature of this perception? What are the possibilities of making practical use of it?

This is still difficult to answer. Extensive and thorough research is required. Such research is already under way.

This case teaches us not to be presumptuous and hold that "science already knows everything". The inquisitive human mind will as yet discover in nature a lot that is amazing and unexpected.

DALTONISM

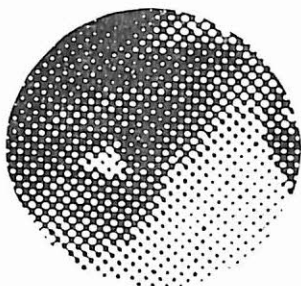
The British chemist and physicist John Dalton, who discovered the law of pressure of a gas mixture, described in 1794 the peculiarities of his own vision: he could not see green and red. Since then this inborn human property—colour blindness—has also been called *Daltonism*.

There are more colour-blind men than women (about 4 per cent of the former and only 0.5 per cent of the latter). Daltonism is incurable, but

it is an inconvenience only in work associated with estimation of colours—chauffeurs, locomotive-drivers, flyers, seamen, artists and house painters.

A person is often unaware that he is colour-blind and finds it out only when taking tests required for his occupation. Such persons are able to distinguish a red flag and green grass by the difference in their shades, but when they are shown special colour tables by an oculist they cannot read the figures on them which are clearly seen by people with normal colour vision.

YOU CAN MAKE OUT
THIS PICTURE



FROM A DISTANCE

IS THE WORLD SUCH AS WE PERCEIVE IT?

"What do you see in this picture?" I asked my young friends showing them a picture taken from the "Optical Illusion" Album compiled in 1924 by Yakov Isidorovich Perelman.* The picture showed a part of an autotype—a print from a stereotype plate—magnified 10-fold.

According to general opinion, it was so many dots and spots.

But when I asked them to look at it from a distance they all saw that it was part of a woman's face with an eye. I wanted to show them how perception changes according to the point of view, not figuratively, as in apperception, but in the literal sense of the word.

"But, if the point of view and the microscope alter perception, if colour-blind people do not see the world the way I do, and if illusions distort my perception, then maybe the world is really different and our sensations are but symbols of the unknown world which only poets are aware of," one of the girls said dreamily.

"Now you are going in for poetry," another girl exclaimed.

"It wouldn't be half so bad, if it were only poetry," I remarked, "but bourgeois idealist agnostics who consider the world unknowable would be pleased to snatch up such statements. Quite a few big minds have slipped into such idealist mire. Although Helmholtz was one of the greatest naturalists, he wrote almost the same thing in his *Physiologic Optics*. "I

* Y. I. Perelman—well-known Soviet populariser, author of the books *Algebra for Fun*, *Living Mathematics*, *Astronomy for Entertainment*, and many others, widely read both in the Soviet Union and abroad.—Ed.

have designated sensations as *symbols* of external phenomena and have denied them any analogy with the things they represent."

Lenin smashed this "theory of symbols", showing its idealist essence and its total untenableness. Like Engels, Lenin considered sensations to be more or less exact copies, pictures, images, mirror reflections of actual reality, and not symbols or hieroglyphs as they were sometimes also incorrectly called. "It goes without saying that an image can never completely compare with the model," wrote Lenin. But a photograph and a microphotograph of an ant, so unlike each other, are still not symbols of the ant, but its images.

Furthermore, it should be remembered that our perceptions are but the first stage of knowledge deepened by thinking and tested in practice.

HOW THEY CONCEIVE THE WORLD

*Some, who can hear music, who can see the sunshine,
Who delight in starlight and marvel at the moon,
Cannot hide their wonder whenever I assure them
That, though deaf from childhood, I can enjoy a tune.*

*Yes, I sense the fragrance and cool of early dew-drops.
My fingers feel an oak-leaf when it flutters like a dove.
Seeped in tender twilight, I go into the garden,
Filled with dreams of beauty, happiness and love.*

*Though I am unable to hear love's ardent whisper,
To see the burning brilliance of passion-kindled eyes,
Yet the human feelings for me, too, have a language
Which I know and treasure like the dearest prize.*

*I could fall in love with a noble, daring spirit,
Just as one could love a sweet flower for its smell,
Or a friend for saying words of consolation,
Or for sweet, clear water a humble village well.*

*With my mind perceiving, with my feelings grasping,
With my fancy drawing the beauty of the world,
I can do much more than many, many others—
I can paint its picture with many-coloured words.*

*Though bereft of sight and the precious power of hearing,
I have live emotions and therefore rich am I.
With the magic lantern of imagination
I weave a lovely carpet whose colours charm your eye.*

*If you are enamoured of poetry and music,
Do not boast about it, but show a gentle soul,
Yes, show me your kindness, give your hand to help me
That I may be with you and not behind a wall.*

These verses were written by Olga Ivanovna Skorokhodova, M. S. in Education, deaf, mute and blind since early childhood. Although she does not perceive the world the way we do, she conceives it similarly. This is evident not only from the above verses, but also from her remarkable book which she entitled: *How I Perceive and Conceive the Surrounding World*.

And here is an excerpt from the autobiographic book of Helen Keller (American writer), also deaf, mute and blind.

"Sometimes, it is true, a sense of isolation enfolds me like a cold mist as I sit alone and wait at life's closed door. Beyond, there is light, and music and sweet companionship, but I may not enter. Fate, silent, pitiless, bars the way. . . . The Bible gives me a deep, comforting sense that 'things seen are temporal, and things unseen are eternal'."

Brought up under different social conditions both Skorokhodova and Keller gained a deep enough insight into the surrounding physical world and learned to love literature, poetry and music. Moreover, they very precisely perceived and mastered the world outlook of the society in which they had been brought up and of which each of them is a brilliant representative.

Chapter 5

ATTENTION

EXPERIMENT WITH A CLOCK AND A BOOK

If you have a clock in your room, you do not usually hear it tick because this monotonous sound escapes your attention.

Try, while reading a book, to put a clock next to it and to divide your voluntary attention so that you simultaneously watch the ticking of the clock and continue reading the book. You will manage for a while, but soon you will either begin to interrupt your reading to hear the clock, or, carried away by your book, will "forget" about the clock. I have put the word forget in quotes because this is not a matter of memory, but one of attention.

Attention is concentration of the consciousness on some perceived or recalled objects with its simultaneous distraction from other objects, i.e., it is an act of consciousness directed toward particular objects. Attention manifests the selectivity of consciousness.

The thing that attracts the attention becomes the "figure" and all the rest—the "background". "In concentrated thinking or in being carried away by something we neither see nor hear anything going on around us, which is a clear case of negative induction," said Pavlov about the physiologic mechanism of distraction of the attention, which we reproduced in the experiment with simultaneous reading and listening to the clock.

Let us recall Pavlov's remarkable figure of speech: If your skullcap were transparent, we should be able to observe during this experiment how the optimum focus of excitation moves now to the centres, which control the reading of the book, and now to those determining the listening to the ticking of the clock.

"ATTENTION SERVICE"

"He is all attention," we say about a person concentrated on hearing, seeing or reading something. Attention manifests itself in a person's facial expressions, gestures and general behaviour.

Bogdanov-Belsky's picture *Oral Count* shows that the thoughts of the pupils standing at the blackboard are concentrated on what is written on it. The teacher is attentively listening to what one of the pupils is whispering into his ear. This is outwardly directed attention. But two boys in the foreground are thinking hard, doing mental arithmetic, straining their inwardly directed attention. Vasily Grigoryevich Perov's painting *Hunters* masterfully depicts the interest with which a young hunter is listening to the story told by his older companion. If attention were not manifested outwardly, artists would find it very difficult to paint pictures and actors to play their parts.

The outward manifestation of attention has its physiologic cause. Remember, I already mentioned the fact that the nerve cells of the so-called reticular formation localised deep in the brain, around the ventricles, are carrying on the "attention service".

A puppy is quietly drowsing. The tone of its cortex is diminished. But whistle, and it will prick up its ears, wag its tail and get ready to jump up. We may say that the whistling has attracted its attention.

But we may also say it differently, namely:

"Through the animal's reticular formation the whistling has, by the orienting reflex mechanism, increased the tone of the cerebral cortex and has put it and the entire organism in a state of readiness to perceive further information and to react to it."

The alarm signal thus ensures the readiness of firemen, the crew of a ship or a military unit to carry out further orders.

SCOPE OF ATTENTION

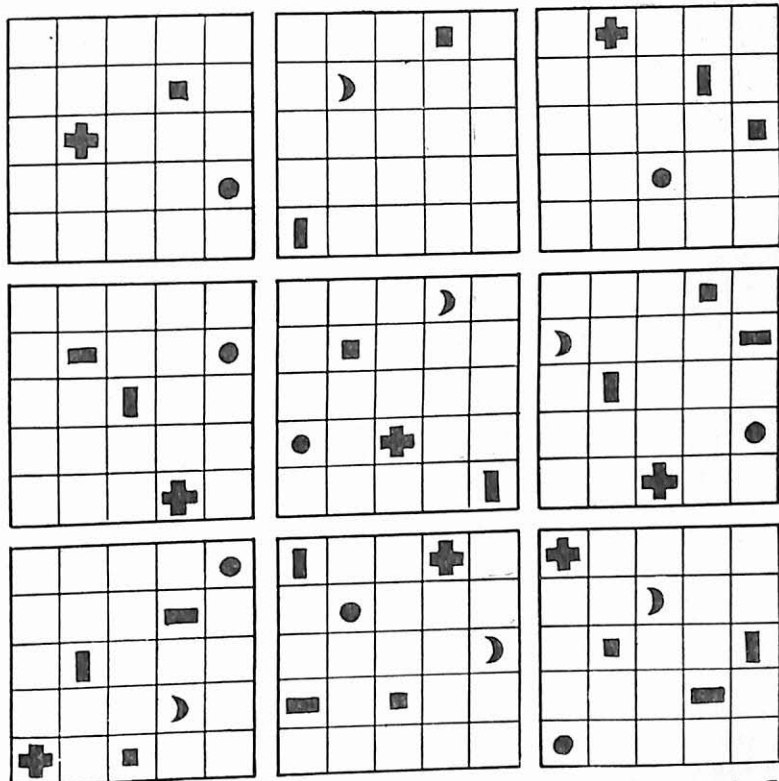
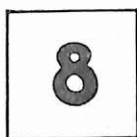
Read to somebody the following assignment:

"I am going to show you for one second a drawing containing several figures. Look carefully to see the figures in the table, and, when I take the drawing away, add the numbers in the figures and write down the sum."

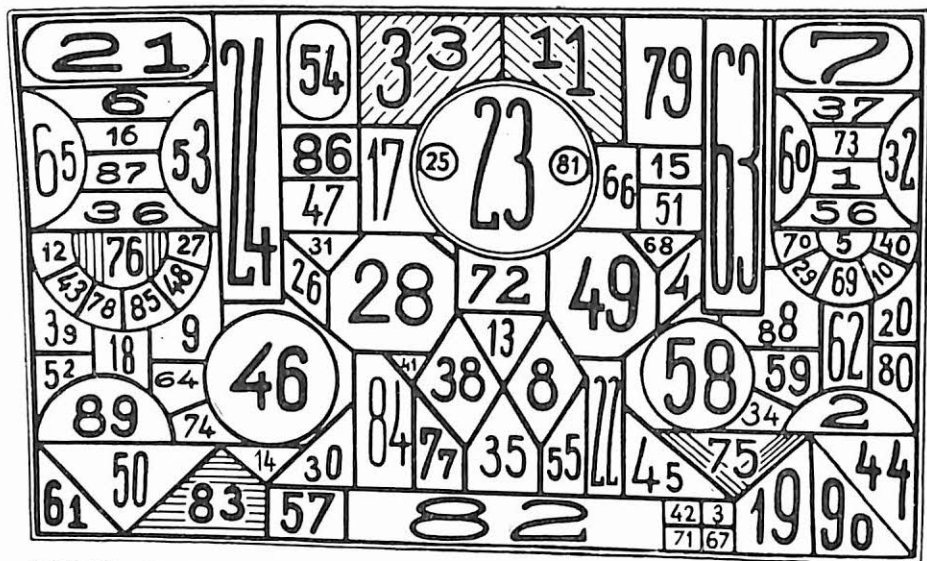
Then, counting to yourself "one-and", show for one second the upper part of the drawing on p. 133, covering the rest with a sheet of paper.

When you receive the sum in writing, ask the person to tell you the number in each particular figure. Rarely anybody remembers these figures. Most people usually say, "I didn't pay any attention" or "I didn't notice". Every now and then someone with a little knowledge of psychology may even say, "The scope of my attention did not suffice simultaneously to note the numbers and the figures."

This experiment illustrates not only the scope of attention, which term implies the maximum number of objects not united in groups, which a person can simultaneously and distinctly perceive in connection with solving some one problem.



TABLES FOR INVESTIGATING
THE SCOPE OF ATTENTION



WHO CAN SUCCESSIVELY FIND ALL THE FIGURES
FROM 1 TO 90 THE FASTEST?

An important part is also played by the selectivity of attention, in this case determined by the assignment. If you add to the above instruction the words: "At the same time remember the numbers in each figure", the attention will be organised differently, although its scope may not suffice to carry out the assignment completely in this case either.

The scope of a person's attention may be determined with the aid of the grid given in the same drawing. Take a piece of cardboard somewhat larger than the open book and make a "window" in it so that you may alternately show the grid through it, the rest of the book remaining covered by the cardboard. Prepare nine empty grids for each "subject". Practice for a while so that you may as rapidly as possible and, what is most important, as uniformly as possible open the "window" and cover it up with your hand. Alternately show each participant in the experiment all the grids, asking them beforehand, firstly, to note as best they can what figures there are in the grids and where they are, and, secondly, after each exposition to place similar figures in an empty grid. You will thus find the person who noted the greatest number of figures in a single grid. The number usually ranges from 4 to 6. The scope of attention may also be evaluated with the aid of the assignment shown in the drawing on p. 134.

INDIAN GAMES

Hunting tribes, for which it is vitally important to have a highly developed faculty of attention, like to play the following game: two or several contestants for some time observe some object and then tell the judge what they saw, each one trying to enumerate as many details as possible.

I explained this game to a number of young people I met in a holiday-home, and we began to play it during our walks.

We divided into two teams, a dozen or so objects placed on a sheet or large kerchief spread before each team. These objects were usually pencils, combs, penknives, cuff-links, pebbles, flowers, beads and pieces of paper. They were arranged so that they were all very well seen. The judge examined both sets of objects, after which they were covered up.

Then the members of each team went, one by one, to the other team's objects, the judge, on the count of "one, two", uncovered them, let the contestants see them and covered them over again. Each contestant had to tell what he saw, giving as detailed a description of each object as possible, including its size, colour, etc. The game ended in uncovering both sets of objects and comparing the individual and team results.

On rainy days we played indoors and sometimes modified the game by using dominoes instead of the objects mentioned above.

In our walks through town we glanced into shopwindows, trying to remember and then describe as many things as possible. We played this game with particular gusto, especially after I had told my young companions that the British psychologist William Carpenter, already known to the reader, had described a case of a juggler who, playing the part of a "clairvoyant", had trained himself, while passing a shopwindow, to notice and describe up to 40 different things.

Within a month we found that our games had improved, although not equally, the faculty of attention of all the participants.

HOW MANY THINGS CAN YOU DO AT ONCE?

Napoleon is said to have been able to do seven things at once. This is hard to believe. But in 1887 the French psychologist Paulhan demonstrated his ability to recite one poem while writing down another. He could do complex multiplication in writing, while reciting a poem. This is a true case.

While teaching a flyer the take-off, the instructor must distribute, or as flyers say, disperse his attention among many processes: determining the distance from the ground, eliminating list and drift, maintaining the direction, and judging the work of the motors by ear. If the instructor

takes off together with the flying student, he must additionally evaluate the execution of every element of the student's take-off.

One's attention has to be divided (distributed) when one is doing several things at once. Applying a psychological pattern to a physiologic groundwork I. P. Pavlov wrote: "Isn't it the usual thing that, while thinking about or doing something, we can simultaneously do something else, something habitual, i.e., we can work with those parts of our cerebral hemispheres which, according to the mechanism of external inhibition, are to a certain extent inhibited because the point of the hemisphere connected with our main occupation is, of course, in a state of great excitation?"

ADDITION WITH SWITCHING-OVER

Write two numbers, one under another, for example, 4 and 2, as shown below. Add them, write their sum next to the upper number and write the upper number next to the lower number. Now add these numbers, prepare two other numbers and continue in the same manner.

4	6	0	6	6	2
2	4	6	0	6	6

This will be the first method of assignment. According to the second method, write the sums in the lower line and transfer the lower number to the upper line, i.e.,

4	2	6	8	4	2
2	6	8	4	2	6

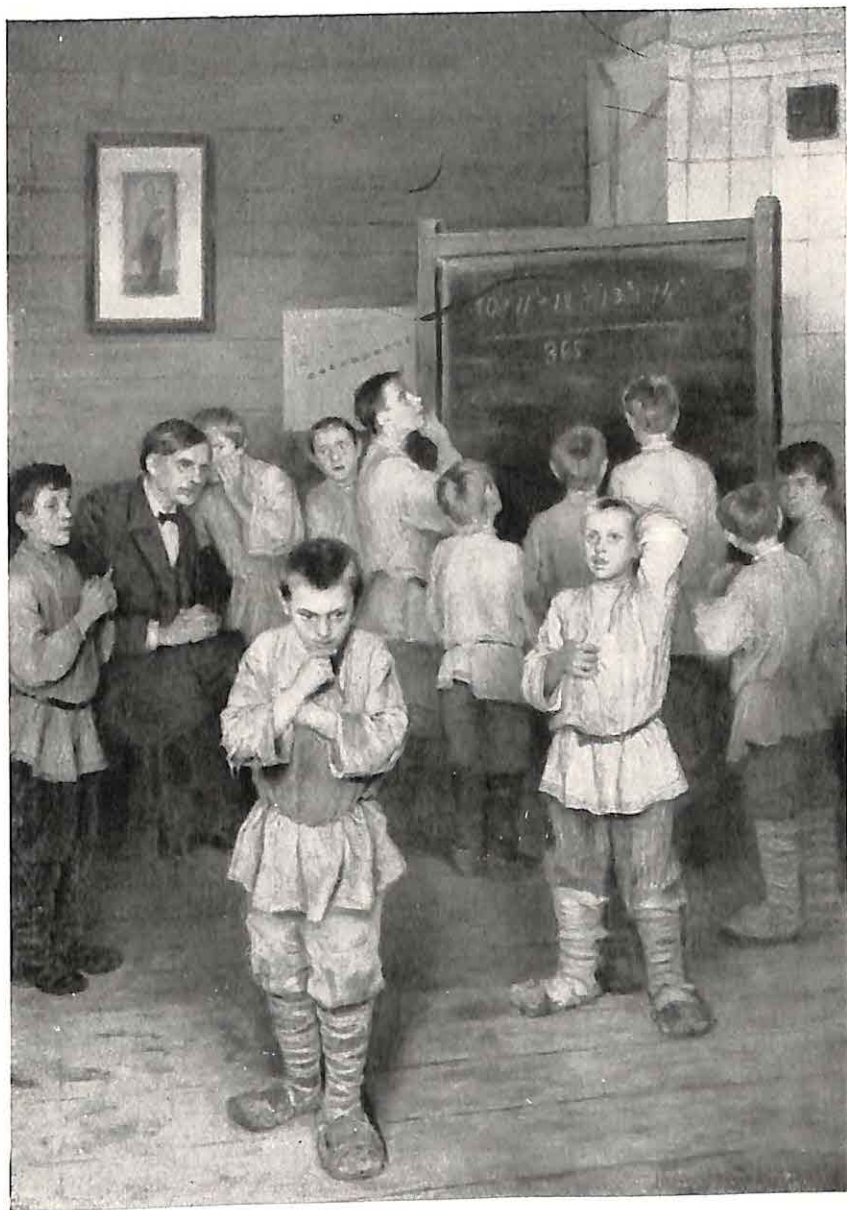
If, as it rarely happens, your numbers will keep recurring, add 1 to one of them.

After a little practice ask somebody to give you every 30 seconds the command: "first", "second", "first", "second", a few times. On hearing the command, draw a vertical line and quickly change to the other method of work, trying to do the assignment as accurately and quickly as possible.

A check-up on what you have done will show you that your mistakes were made mainly as you switched over from one method of work to the other.

Performing this experiment with different people you will find that the results will vary since they depend on the mobility of the nervous processes which determine the ability to switch one's attention. A person doing this assignment when tired will show poorer results.

A switching-over of attention is a reorganisation of attention, its transfer from one object to another in connection with a change in the objective of its activity.



"ORAL COUNT"

(REPRODUCTION OF A PAINTING BY I. BOGDANOV-BELSKY)



"HUNTERS" (REPRODUCTION OF A PAINTING BY V. PEROV)

PERSEVERATION

When examining a patient at the end of my office hours I usually noticed that I could not stop thinking about the preceding patient. I confused their complaints and symptoms, which very much interfered with my work.

Try, in the morning after a good night's sleep, quickly to draw small triangles, now with the apex up and now down, or to write now the letter "Z" and now its mirror reflection. You won't find this assignment any too difficult.

But try this exercise in the evening, when you are very tired, and you will start repeating the same figure over and over again. This is so-called perseveration (which I discussed in a story on p. 31), a phenomenon connected with the difficulty of switching over one's attention.

The physiologic mechanism of both perseveration and difficulties of switching over one's attention is a slowing of the alternation of the processes of excitation and inhibition in the cerebral cortex or, in the language of physiology, inertness of the nervous processes in cortical neurodynamics.

FLUCTUATIONS OF ATTENTION

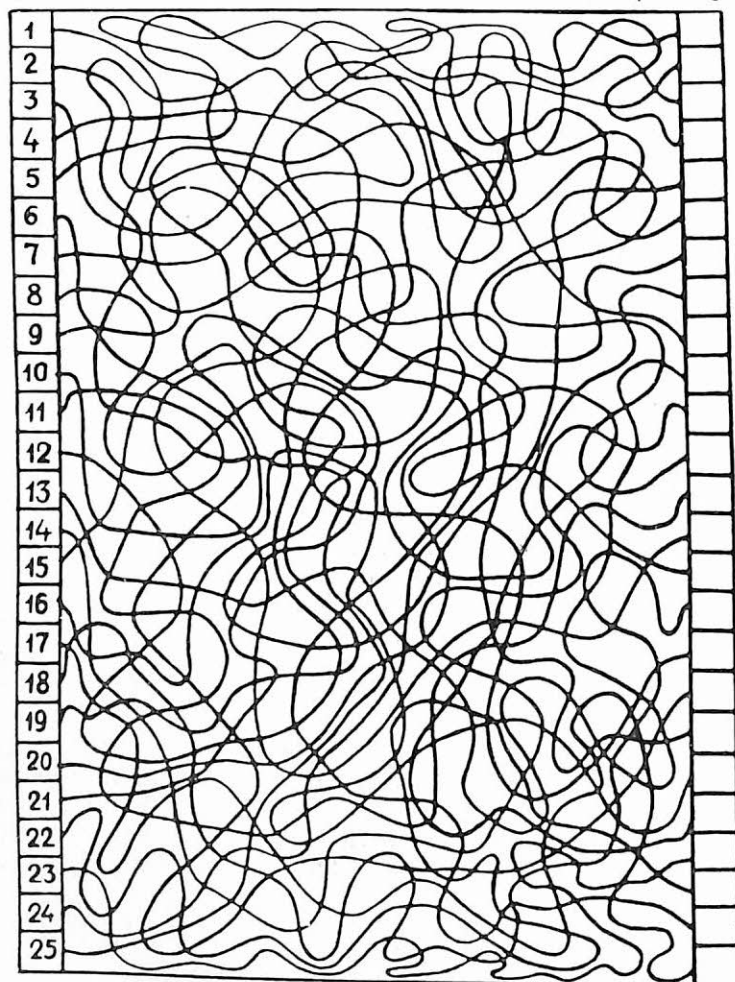
Attention may be weakened for a longer or shorter period. Its fluctuations are observed in all people without exception.

Straining your voluntary attention, try to look for several minutes at one of the dual pictures shown on p. 117. At first try to see the two images in the picture several times alternately and then try to see only one of them. You won't be able to do it because of the fluctuation of attention.

Each time the other figure intrudes itself upon your mind strike the table with a finger and ask somebody to record with a stopwatch the seconds in which you strike the table. You will thus be able to measure the fluctuations of your attention. Performing this experiment with other people and other dual pictures you will find that attention does not always fluctuate equally in all people.

If, after finding the auditory threshold (I have already told you how to do it), you hold the watch in the same position, its ticking will seem to disappear and reappear also because of fluctuation of attention. This phenomenon could be observed at anti-aircraft defence posts during the Patriotic War when a plane flew at a "threshold" altitude for the observer. A lark soaring high in the clear sky similarly disappears and reappears.

TO FOLLOW EACH OF THESE LINES WITH
THE EYES FROM BEGINNING TO END REQUIRES



STABILITY OF ATTENTION

CONFUSION

Try to trace with your eye (not with a pencil) as quickly as possible each of the lines shown in the drawing on p. 138.

On the strip to the right of the drawing, where each of the lines ends, write the number of the line. Checking up on yourself with a little stick (rather than with a finger or pencil so as not to soil the book) you will probably find several mistakes made through insufficiently stable attention at the points where the lines cross.

Stability of attention is the ability to direct it for a long period toward something, and the resistance of attention to fatigue and distraction.

FLITTING AND STICKY

"An excessively restless and impressionable pupil keeps moving about and looking at his classmates during the lesson, and does not hear me. I say to him, 'You are very inattentive.' Another pupil is lost in reverie, musing over a book he has recently read. He is not listening to me either, and I say to him, too, 'You are very inattentive.' But the two of them are differently inattentive. What am I to do with them?" a young teacher asked me.

She is right in that there are two kinds of absent-mindedness which are in a way contrary to each other. The former is called "flitting attention"; it is determined by an involuntary, easy switching-over of feeble, unstable and outwardly directed attention, which is particularly characteristic of children.

The other kind of absent-mindedness is aptly called "sticky". It is characterised by difficulty of switching over very intense and stable, most commonly inwardly directed attention. Many of the jokes about scientists concentrated on their own thoughts illustrate precisely this type of absent-mindedness.

However, both types of inattentiveness may manifest themselves not only in children and scientists, but also in each and everyone of us.

Which of these two types of inattentiveness is worse?

It all depends under what conditions and in whom it manifests itself. For chauffeurs, tram-drivers, engine-drivers and flyers "sticky attention" may result not only in errors, but also in accidents. In some cases, however, such attention is useful and is, then, not referred to as "sticky". The following may serve as an illustration.

Newton wanted to boil an egg. Taking a watch he noted the time he started the cooking. After a while he discovered that he was holding the egg in his hand and was cooking ... the watch. But, when the scientist was once asked how he had managed to discover the law of gravitation, he said:

"Because I kept thinking about it all the time."

Georges Cuvier (1769-1832), great French naturalist, defined "genius", on the basis of Newton's foregoing words, as incessant attention.

PROFESSIONAL ATTENTION

Karl Marx wrote: "In addition to using the organs which do the work, the worker requires expedient volition which manifests itself in attention; it is the more necessary, the less the worker is interested in his work (its content and method of performance), and, consequently, the less he enjoys it as a play of his physical and intellectual powers."

Different occupations require different attention. A watchmaker's attention is concentrated. The attention of the officer at the radar screen of a modern ship sailing in a fog is still more concentrated.

The attention of an engine-driver, chauffeur, flyer, policeman and orchestra conductor is very diffuse and can be quickly switched from one thing to another. The control panel of the atom-powered ice-breaker *Lenin* contains more than 250 devices and signals, and the officer on duty must not only continuously switch his attention from one device to another, but must also widely distribute it. The attention of a physician examining patients or of a teacher teaching a class does not have to be switched so often from one thing to another, but the switching-over must be thorough-going.

The automation of socialist industry and agriculture enhances the role of so-called observing occupations. The principal function in these occupations is careful reading of the instruments.

SOCIALLY-TRAINED ATTENTION

Must you say "bless you" to the person who has sneezed?

I don't think this question can be answered in general. Sometimes it is not out of place to help a young lady who sneezed in new company out of her embarrassment with a jesting "bless you" and sometimes tactfully to fail to notice the sneezing. It is scarcely necessary to watch carefully every sneezer and maintain a tradition that arose at the time when people used snuff and offered it to each other from a snuffbox. Nor is there any reason to fight this tradition since there is no harm in it.

But inability to control one's own attention may prove harmful.

A person is knocked down by an automobile. Within a few minutes he is surrounded by a dense crowd of idlers who, far from being of any help, only offend the victim with their socially-untrained attention and

get in the physician's way. The physician is young and excited, the crowd is in his way, but he tries to pay no attention to the people in order to administer first aid to the best of his ability. The life of the victim often depends on the physician's socially-trained attention.

And here is another case. A person has taken offence at something, seriously and justly. All his attention is focussed on the offence. It never occurs to him that he, too, may have been wrong. He recalls his offence for the twentieth or even for the hundredth time and finds increasingly new arguments in favour of his rightness. His friend thus gradually becomes his foe. It happens that, owing to such inability to control one's own attention, a reluctance to switch one's own thoughts temporarily over to other subjects, a former favourite becomes disliked. But, if the offended person were able to control his attention and to switch it deliberately over to other subjects, he would soon see the incident in a different light, would remain a friend, and his favourite would continue to be his favourite.

To control one's own attention means to be able not only to direct it at something that must be noticed, but also to refrain from directing it at a thing that must remain unnoticed.

Must or must not for whom? For oneself?

Yes, sometimes for oneself, but most commonly both for oneself and for others. And only in the latter case can one's attention be called socially-trained.

HOW TO BECOME ATTENTIVE

"I have learned something new about the various aspects and manifestations of attention, but I have not yet learned the thing that is the most important for me and, probably, for many others. You have not taught us what to do to become attentive."

The above may be said by any reader as he notices that the chapter is nearing its end.

But is it at all possible to advise the reader how to develop his attention without knowing his occupation?

I have really saved the answer to this question for the end of the chapter.

It goes without saying that a young musician must develop his attention in a somewhat different manner from that of a young chauffeur or draftsman. But there are some general rules for many people, if not for all. Moreover, one must be attentive not only in work. A musician may have to drive his car, a chauffeur may have to make the drawings of his own invention and may play the violin, while everybody needs socially-trained attention.

The only right way to train one's own attention is to teach oneself to do everything attentively.

A person must learn to direct his attention voluntarily and purposefully at a definite object without allowing any external stimuli to distract him. The development of the stability of human attention is connected with the development of man's volitional qualities, and one must therefore discipline oneself to be master of all one's actions to the least little detail.

Systematic exercise in simultaneously doing different things is very useful, but it must be done so that the general perception of each thing is retained for a long-enough time and yet so that the main thing is singled out and the attention is concentrated on it.

In the story of "Indian Games" I told the reader how to develop the scope of attention.

The training in switching one's attention from one thing to another must proceed along three lines:

- training in actually and quickly switching one's attention from one thing to another;

- training during this switching in what is figuratively called elaboration of the "route of perception";

- training in the ability to single out the most important things from those of secondary importance.

But the best method of becoming attentive is never to allow oneself to do anything inattentively.

Chapter 6

THINKING



WHAT IS A MILLION?

"How starry the sky is tonight," said little Lena. "There must be a million stars."

"Not at all," rejoined Gera who likes mathematics and precision. "You can see only about two and a half thousand stars with the naked eye."

And yet you can see a million just the same. An open newspaper sheet shows about 50,000 letters. If we spread 20 newspapers in a hall, we shall be able to perceive with one glance about a million letters on an area of some 10 square metres.

This graphic, but not adequate image does not disclose the essence of a million; the concept of a million as a thousand thousands or as 10^6 is much more complete. It is an example of the fact that thinking is more far-reaching than perception and conception. V. I. Lenin wrote in his *Philosophic Notebooks* that "conception cannot grasp motion as a whole; for example, it does not grasp motion at the rate of 300,000 kilometres per second, whereas *thinking* does and must grasp it".

Psychology defines thinking as mental activity aimed at generalised and mediated cognition of objective reality by discovering the connections and relations existing between the objects and phenomena being cognised.

Defined more concisely, thinking is a reflection of the connections between objects and phenomena.

"But, although very brief definitions are convenient, since they represent a summary of the main thing, they are nevertheless inadequate, if it is necessary to derive very essential features of the phenomenon which has to be defined," said Lenin. Now you have read these definitions of thinking

and do not, I am sure, very well understand them. I have an idea that when you read some of the other definitions I gave in this book you merely ran your eyes over them.

Any definition is useful only to those who already have a good deal of knowledge about what is being defined, in which case the definition helps to emphasise the main and most important things. In other words, understanding a definition is a process of thinking.

When you have read this chapter to the end go back to these definitions once more and you will find that you understand them much better.

DIRECTLY AND MEDIATELY

"You sometimes use the word 'mediately'. You have also used it in your definition of thinking. What does this word mean and can it not be replaced by a simpler one?" I read in a note sent to me during my lecture on thinking. I started my answer with an example.

A person's height can be measured directly by using a ruler, but Thales in the sixth century B.C. solved the problem of measuring the height of a pyramid. At the moment when the length of his shadow equalled his height he measured the length of the shadow of the pyramid. Consequently, he measured the height of the pyramid not directly, but mediate, including mathematical calculations in his following deduction: if the length of my shadow now equals my height, the length of the shadow of the pyramid must now also equal its height.

Mediation, in the broad sense of the term, means generalisation by thinking of the information about the surroundings, which we receive through sensations and which is the result of the stimulation of our sense organs by the external world. That is why perception ensures direct cognition of the world, and thinking provides mediate cognition of that which cannot be cognised directly. The word "mediately" cannot be replaced by any one other word.

WHAT IS A GLASS

Take a glass and look at it. Many different sensations are generalised in our consciousness as we perceive the glass.

Put the glass on the table and, closing your eyes, try to call to your mind as many of its details as possible—shape, size, weight, thickness of walls, temperature, smoothness, etc. This will be a rather complete and clear idea of the glass. But here is what Lenin said disclosing the multi-formity of the concept "a glass":

"A glass is no doubt a cylindrical vessel and something to drink from. But a glass has not only these two properties or qualities or aspects, but also an infinite number of other properties, qualities, aspects, interrelations and 'mediations' with the rest of the world. A glass is a heavy object which can be used as an instrument for throwing. A glass may serve as a paper-weight, as a place for a captured butterfly; it may have a value as an object with artistic carving or pattern regardless of whether it is fit for drinking, the material of which it is made, and whether its form is cylindrical or not strictly so, etc., etc.

"Further. If I need a glass now, as something to drink from, I do not have to know whether its form is strictly cylindrical and what material it is made of, but it is very important that it should not be cracked, that I should not cut my lips using it, etc. But, if I need a glass not for drinking, but for something that any cylinder will do, I can then use one with a crack in its bottom or even one without a bottom, etc.

"Formal logic to which the teaching in schools is restricted—with corrections—in the lower grades takes formal definitions, guiding itself by what is the most common or what most frequently strikes the eye and limits itself to it. If it takes two or more different definitions and unites them quite accidentally (the cylinder and the thing for drinking) we get an eclectic definition which indicates different aspects of the object and no more.

"Dialectic logic requires that we go farther. To have real knowledge of an object, it is necessary to grasp, to study all its aspects, all connections and 'mediations'. We shall never be able to do it completely but the requirement of all-sidedness will safeguard us against errors and mortification. . . ."

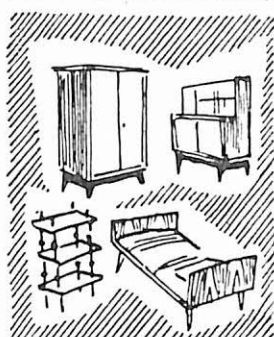
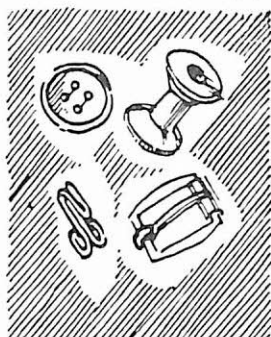
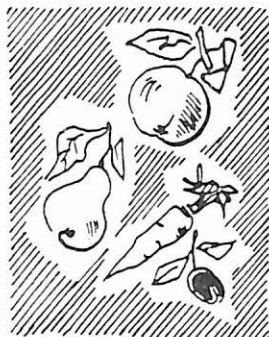
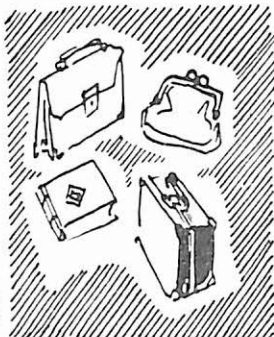
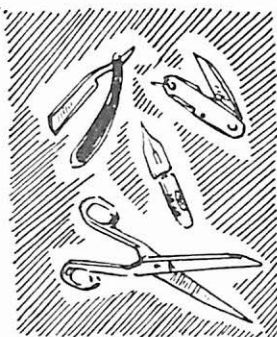
Psychology defines a concept as a form of thinking which reflects the general and essential properties of objects and phenomena.

SUPERFLUOUS FOURTH

Solve the problem in the picture (p. 146) yourself and ask others to solve it. If you happen to differ in the results, see who eliminated the superfluous object and why. This is a problem of generalisation.

Generalisation is one of the basic forms of thinking. It is a mental singling out of that which is common to objects or phenomena and their mental unification based on it.

The differences of opinion concerning the superfluous object may be due to the fact that some persons will generalise them not by



FIND THE "FOURTH SUPERFLUOUS" IN EACH OF THESE PICTURES

their most essential signs, but by casual associations. We shall discuss associations later, and that is when you will find the correct solution to the problem.

EUREKA!

The story goes that, while taking a bath, Archimedes noticed that his body immersed in water lost weight. It then occurred to him how he must solve the problem he had been given by the king of Syracuse, namely, to find out whether or not the jeweller had stolen any gold, while remolding his crown, and had added silver to it. He jumped out of the tub and running naked through Syracuse kept yelling: "Eureka!" which in Greek means "I have found it!"

Thus was discovered the Law of Archimedes.

Has not any of you experienced the remarkable moment when, as though after groping in the dark and failing to understand, you suddenly—precisely suddenly!—see, like a ray of light, the only correct solution, and you are gripped by a joyous feeling of certainty and triumph.

The mental action by which an elementary and no longer divisible conscious aim is achieved can be graphically represented by the diagram shown on p. 148.

WORKING A CROSSWORD PUZZLE

"I am very fond of crossword puzzles," a schoolboy once told me. "While working them out, I find that some words come to my mind easily, some follow each other and even occur in heaps. But it also happens that you think of the wrong word and then, try as you will, there is nothing you can do. It is a very unpleasant feeling when your head is a vacuum or when you keep thinking of the same word, although it is the wrong one."

The boy's observation was correct. And this is why such a thing happens. The first two cases are a manifestation of resourcefulness based on adequate knowledge and connected with good mobility of the nervous processes; the latter case manifests lack of knowledge. There are usually two reasons for it. Firstly, it may be a mere lack of knowledge, and, secondly, as in the last case mentioned by the schoolboy, it may be an inertness of the nervous processes, a manifestation of perseveration. The thought that occurs is not inhibited, but, on the contrary, itself inhibits other thoughts and makes it impossible to check on them.

The crossword puzzle fan failed to note one more phenomenon taking place during the quest for the needed word. I am referring to uncritical thinking. In this case the first word that comes to mind is accepted as the answer without any check-up. It is also possible to note various degrees of quickness or slowness, vigorousness, resourcefulness and depth of thinking.

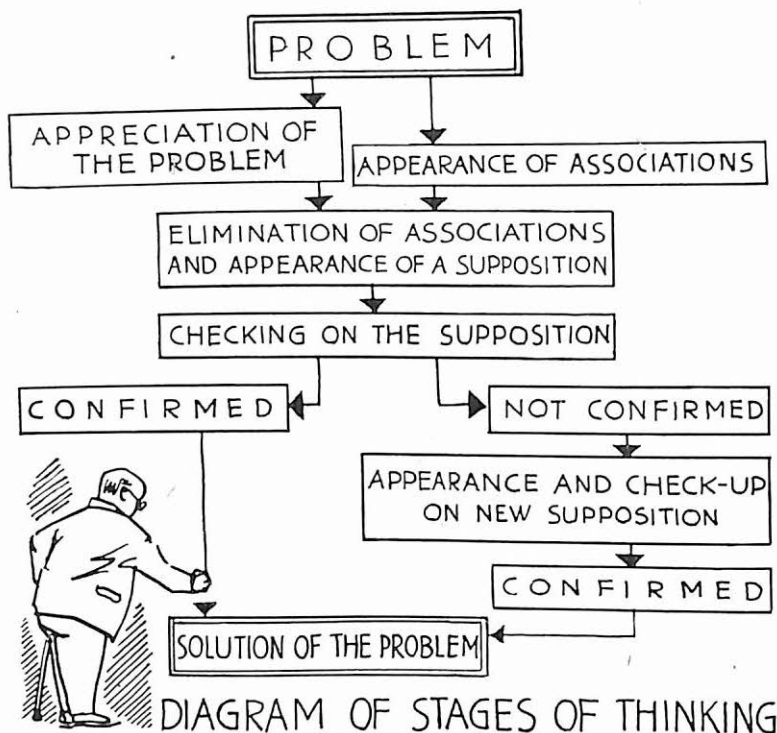


DIAGRAM OF STAGES OF THINKING

I advise the reader, while working out a crossword puzzle, to try and trace on himself all these forms and characteristics of thinking which manifest themselves during the solution of any mental problem.

LOGICAL PROBLEMS

There are many types of problems whose solution requires special knowledge of algebra, geometry, physics, etc. But there are problems that require only the ability to think, only resourcefulness. They are called logical problems.

It is interesting that the solution of logical problems, while fitting into the diagram of the stages of mental actions, models scientific research. Here is a simple logical problem.

Jack is twice as old as Jim will be when Bob is as old as Jack is now. Which of the boys is the oldest, which the youngest and which is in between?

I am giving you the answer to this problem right here in order that it may help you solve similar problems; Jack is the oldest, Bob is next, and Jim is the youngest.

ORACLE UNMASKED

Long, long ago there was, in one of the eastern countries, a famous oracle. Unlike other oracles, it prophesied in the name not only of one god, but of three gods—the god of truth, the god of untruth and the god of diplomacy. The gods were represented by absolutely similar images placed behind the altar before which people sought advice on bended knees.

The gods always answered questions willingly, but they were so alike that nobody could tell whether the answers were given by the god of truth who had to be believed, the god of untruth who always spoke the untruth, or the god of diplomacy who could either lie or tell the truth. That played into the hands of the priests and promoted the oracle's fame, since the gods always proved right.

But one day came a man who looked like a simpleton but who decided to do what the greatest sages had been unable to do before him. He made up his mind to identify each of the gods.

The man entered the temple and asked the god standing on the left: "Who is standing next to you?"

"The god of truth," was the answer.

Then the man asked the god standing in the centre: "Who are you?"

"The god of diplomacy," came the answer.

The last question was put to the god standing on the right: "Who is standing next to you?"

"The god of untruth," the latter replied.

"Now everything is clear," said the man who looked like a simpleton.

What did the answers of the oracle make clear to the man? Think it over and you will be able to check up on yourself by the answer which you will read in one of the subsequent stories.

BY ASSOCIATION

When the word "association" is used in psychology it implies a connection between the ideas in virtue of which some of them, having appeared in the consciousness, call up others.

I suggest the following. Let one of the participants in the experiment be the experimenter and the other—the subject. The experimenter utters some word and starts the stopwatch. Such “word stimuli” may be prepared beforehand by writing them down on paper in a column, but, of course, so that nobody should know them; the words may be, for example, day, table, river, eye, oak, penny, ray, book, garden, knife. The subject must as quickly as possible say the first word that comes to his mind and is logically connected with the word stimulus. As soon as he starts speaking the experimenter stops the stopwatch and writes down the “reaction word”. If you collect many such records, you will convince yourself that the association time averages 1.5 seconds.

Associations of three types are distinguished, according to content, as proposed by Aristotle. They are:

Associations by contiguity, when one idea calls to mind another idea owing to their temporal or spatial coincidence in the past: snow—winter, rain—wind, chair—table.

Associations by similarity may be according to external, superficial characteristics: lake—sea, whale—fish, aircraft—bird, or according to essential characteristics, for example, razor—knife—scissors (cutting instruments), brief-case—wallet—valise (containers), saw—axe—drill (carpenter's tools), apple—pear—plum (fruits), button—hook—clasp (fastening devices), trumpet—tuba—saxophone (wind instruments), watch—scales—thermometer (measuring instruments). These examples furnish the answers to the pictures on p. 146.

Associations may be by contrast: white—black, good—evil, light—dark.

This experiment may be somewhat varied. After the word is given the subject must, for a period of one minute, call as many words as possible without connecting them in phrases. The result will show that the number of words which different people can think of in one minute will greatly differ; this is due not only to the speed with which they are uttered, but also to the pauses between them.

It would be interesting to divide these words according to the types of associations and see what happens. Don't think, however, that the number of words mentioned by contiguity will show the resourcefulness of the person who understood that “this is easier”. It will rather betray the poverty of his associations.

The associations by similarity and contrast are more complicated than those by contiguity. The latter include the usual word combinations, and in poetry—“hackneyed rhymes”.

Associations by similarity play an important part in teaching and in so-called associative memorisations, as well as in poetry.

REGULARITY

Scientific thinking is based on the process of finding regularities, i.e., constantly recurring cause and effect relations. This process is not hard to model.

The picture shows several numbers and figures, these numbers and figures varying in each series with a certain regularity. To continue each series (it is best to do it on a sheet of paper so as not to spoil the book and to be able to let others do the problem), it is necessary to grasp this regularity).

Now try your hand at it.

SPEAKING ANIMALS

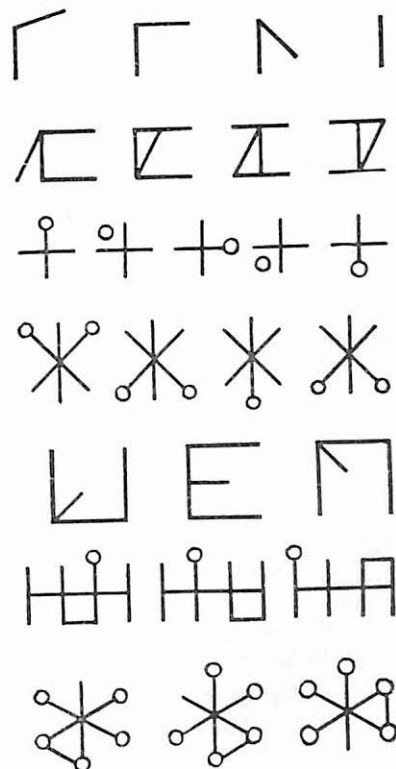
Once, after one of our regular long trips to the country we stopped for the night at the house of a hospitable forester. The latter turned out to have a starling who very clearly called his master by name. This led our conversation to the subject of speaking animals.

My companions recalled the raven in Durov's corner; asked, "What is your name?" the raven always answered, "Little Raven". Then we recalled our chats about the methods of training animals, about Clever Hans—the horse with "unprecedented mathematical abilities", and about the need domestic animals have for speech. I told the company about the chimpanzee Ioni who was studied by the zoopsychologist N. N. Ladygina-Kots. The scientist had found that the chimpanzee uttered 20 different sounds, each expressing a certain feeling or wish of the animal.

"Of course," I said, "speech is the property of man alone; animals do not speak,

CONTINUE EACH ROW
ACCORDING TO THE
REGULARITY YOU
HAVE DISCOVERED

6 10 14 18 22
10 12 11 13 12
24 21 19 18 15
3 6 8 16



but only utter sounds which express their moods or imitate the sounds of human speech. The parrot equally well imitates man, the dog, the cat, other birds and even the creak of the door."

"In the developing animal kingdom an extraordinary addition to the mechanisms of nervous activity occurred during the human phase. For animals reality is signalled almost exclusively by stimuli and their traces in the cerebral hemispheres, the stimuli going directly to special cells of the visual, auditory and other receptors of the organism. This is what we, too, have as impressions, sensations and concepts about the surrounding external environment, both natural and social, except the word heard and seen. This is the first signalling system of reality, which we have in common with animals. But the word has formed the second, specifically our signalling system of reality, being the signal of the former signals. On the one hand, the numerous word stimuli have removed us from reality, and we must therefore always remember this in order not to pervert our relations with reality. On the other hand, it is precisely the word that has made us human, of which there is, of course, no need to speak here. It cannot be doubted, however, that the principal laws established in the work of the first signalling system must also govern that of the second signalling system because it is work of the same nervous tissue."

These words are taken from Pavlov's article "The Conditioned Reflex" which discloses the differences in the higher nervous activity of animals and man and the physiologic essence of human thinking and speech.

I KNOW IT, BUT I CAN'T SAY IT

Schoolchildren have an expression: "I am like a clever dog; I know and understand everything, but cannot say it." Some of them even take offence when the teacher gives them a low mark, since they are sure they know the lesson, but merely cannot answer it.

Of course, such pupils are wrong. If a person knows something, he can say it, and if he cannot say it, he does not know it. He has only "fragments of thoughts", vague recollections of what he had at one time heard or read; these recollections are sometimes reinforced by an illusion of knowledge.

Difficulties in the motor component of speech are a different matter. Here are several phrases, simple and comprehensible. Yet not everybody can say them, especially quickly and articulately. Some people will find some of these phrases difficult, while other phrases will prove difficult for other people. Try to utter them as quickly as you can.

If Peter Piper picked a peck of pickled peppers where's the peck of pickled peppers Peter Piper picked?

How much wood could a woodchuck chuck if a woodchuck could chuckwood?

I CAN SAY IT, BUT I DON'T KNOW WHAT IT IS

When I was young I knew a man who was very fond of saying all sorts of highfalutin words, although he did not know what they meant. One of the words he particularly liked was "materialised". He would usually let go like this:

"Do not enumerate your feathered flock until the process of incubation has fully been materialised."

"That's what it says in one of the cleverest books I have ever read," he would add.

He had even taught his parrot to say that, and I must confess, alas, that I, too, have memorised this sentence. But neither he, nor I, nor his parrot knew what this term or the rest of the sentence meant.

I can say the same thing about the set of meaningless words we used to determine the "it" when we played games in childhood. I am inclined to believe that very few of my readers understand the words "eeny, meeny, miny, mo", but remember them from their childhood games. The words were unintelligible, but they fascinated our childish imagination.

How often adults are happy when children utter highfalutin words without in the least concerning themselves with whether or not the children understand them.

And here is the answer to the riddle of the unmasked oracle. The god of diplomacy was on the left, the god of untruth—in the middle, and the god of truth—on the right. If you have not solved the riddle yourself, you will now at least be able to tell it to others, although you will yet have to do some thinking to understand it.

ACTIVE VOCABULARY

An active vocabulary is the number of words a person regularly uses in his oral and written speech and is always smaller than the total number of words the person knows.

Last century the famous Russian lexicographer Vladimir Dal recorded about 200,000 Russian words. Now the Russian vocabulary numbers some 500,000 words, whereas the records of the Department of Vocabulary of the Institute of Linguistics account for close to seven million different meanings of Russian words.

The larger a person's active vocabulary, the richer his thinking. Children to whom adults speak but little develop more slowly.

The next time you speak to a friend or listen to a lecture pay attention to the speaker's active vocabulary. You will, of course, be unable to record it in precise figures, as is now being done in the U.S.S.R. with Pushkin's,

Shakespeare's and Goethe's active vocabularies, but you won't have any difficulty forming a general opinion of how rich or poor it is, which is not devoid of interest.

DID MAUGLI REALLY LIVE?

The image of a person who was nursed by an animal but did not lose his human qualities always excited the imagination. Romulus and Remus, the founders of Rome, were, according to legend, suckled by a wolf. The wonderful, deeply poetic image of Maugli, the man-wolf created by Rudyard Kipling, British writer and poet, has won the sympathies of millions of readers. The cheap novel and films about Tarzan of the Apes, the man nursed by an ape, were also read and seen by millions.

The French philosopher Etienne Condillac described, as far back as 1754, a Lithuanian boy who had lived among bears. When this boy was discovered by people he manifested no signs of intelligence, could not speak and walked on all fours. It took him quite some time to learn to understand human speech and to speak, but he was then unable to recall anything of his past life among animals.

THE CAPITOLINE WOLF



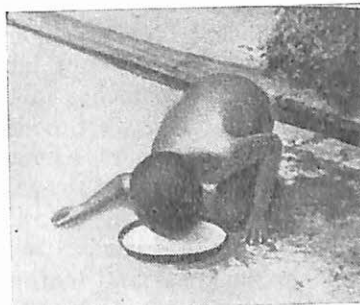
SCULPTURE, 6TH CENTURY B.C.

In his *Outline of Science about Man* written in 1813 the utopian socialist Saint-Simon said, "At various times and in various countries it happened that children, due to some calamity, found themselves removed from society and had to provide for all their needs without being beforehand acquainted through training and education with the knowledge successively acquired and accumulated by the labours of the preceding generations. Observations of these savages prove that man left to himself before being acquainted with the acquired knowledge is but very slightly above animal mentally." He described such an "Aveiron savage" of his time "whom some abbot named Sicar and versed in theology much more than in physiology" unsuccessfully tried to use for demonstrating the divine essence of man, while Itar, a physician of the deaf-mute asylum, tried almost as unsuccessfully to teach speech and human behaviour.

Children nursed by animals were known in the distant past in Rome, Sweden, Lithuania, Belgium, Hungary, Germany, Holland, Ireland and France. Some 30 such cases have been recorded. All these children emitted inarticulate sounds, could not walk upright, possessed great muscular power and agility, ran very fast, jumped and climbed excellently. They had well developed hearing, vision and olfaction. Not all of them learned to speak even after a long period of time.

In 1920 Doctor Singh discovered two little girls together with wolf-cubs in a den in India. One of the girls was about 8 and the other was 2 years old. The younger one soon died, while the older, who was named Kamala, lived for about 10 more years. All that time Singh kept a detailed diary of his observations. Kamala walked on all fours,

CHILDREN NURSED BY WOLVES, AS KAMALA



(14 MORE SUCH CASES ARE KNOWN)

BY BEARS



(5 SUCH CASES ARE KNOWN)

BY BABOONS



ONE SUCH CASE IS KNOWN

ONE CHILD IS ALSO KNOWN
TO HAVE BEEN NURSED BY
LEOPARDS AND ONE BY A SHEEP

CAN NEITHER
WALK, TALK
NOR THINK

resting on her hands and knees, and ran on her hands and feet. She lapped up liquids and ate meat only from the floor, never taking it out of anybody's hands. When approached while eating, the girl growled. At night she howled.

The girl saw very well in the dark and was afraid of strong light, fire and water. She did not let herself be washed. In the daytime she slept sitting on her haunches in the corner, facing the wall. She tore clothes off her body and threw off the blanket even when it was cold.

Within two years Kamala learned to stand, although poorly; within six years she learned to walk, but continued to run on all fours, as before. In the course of four years she learned only 6 words and in the course of seven years—45 words. By that time she had come to like people, began to fear darkness and learned to eat with her hands and drink from a cup. By the age of 17 she had the mental development of a four-year-old child. Kamala was very fond of the other girl who had been found together with her, and when the latter died she took no food or drink for two days.

In 1825 the case of Kaspar Hauser was reported in Germany. When still a child he had been incarcerated in a cellar where he lived for many years feeding on whatever food was thrown to him. Physically he was much weaker than normally developing people and children nursed by animals, but hardly differed from the latter in mental development.

All these cases show that it is much more difficult to re-educate a human being than to educate him properly in due time.

Wherever a child may be growing he will first have and then lose his milk teeth; a girl will grow long hair, and a boy's treble will be replaced by a man's voice.

But man's psychic qualities cannot develop that way. Without a collective and social life man cannot develop as a personality and remains an animal.

It follows that man's mental development is determined by social influences. Consequently, we must be able to utilise these influences in the requisite direction.

WRITTEN LANGUAGE

A person reads a letter which makes it possible to transmit the thoughts expressed in it over a distance and to preserve them in time. A letter is called recorded speech. The characters of the letter express certain elements of speech.

MAN CAN READ NOT ONLY RECORDED SOUNDS,



Writing in which each symbol represents a speech sound is the easiest to read. But with the Morse code it is possible not only to record thoughts on paper, but also to transmit them over a distance by means of sound or light signals.

In pictography—picture writing—the most ancient form of writing, the objects, actions and events were represented by conventional pictures.

Hieroglyphics were at first pictographic, but then gradually became ideographic, the ideograms (symbols) standing for words or concepts, as the Egyptian and Chinese hieroglyphs.

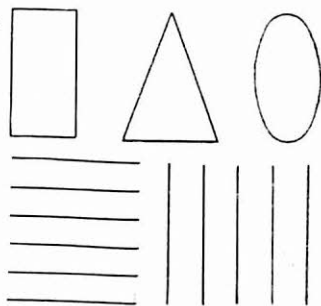
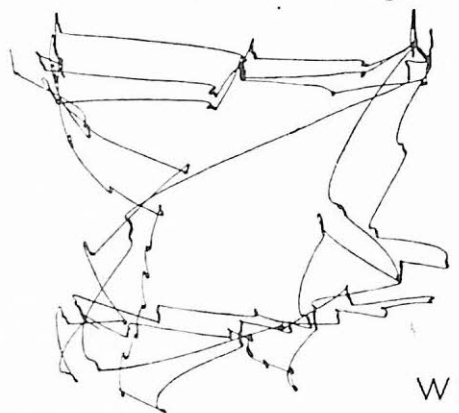
The so-called Arabic numerals or figures (actually they are Indian) represent ideographic writing, while the Roman numerals are pictographic writing.

The reading of music resembles that of recorded speech sounds; the reading of a drawing, plan, topographic map, and traces resembles the reading of pictographic writing. The readings of various control instruments are perceived as ideographic writing.

FEELING EYE

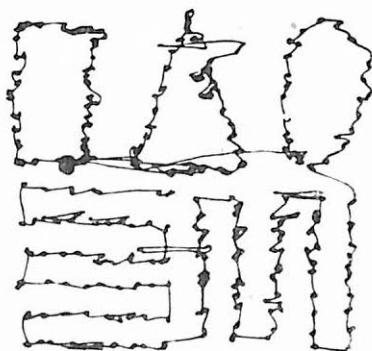
Look from the side at the eyes of a person reading a book and you will see that they do not run smoothly over the lines, but stop and then jump over them. In reading the shift of the eyes takes only 0.03-0.01 seconds. This "feeling" movement of the eyes can be precisely recorded by various methods not only when a person is reading a book, but also when he is examining some object. Page 158 shows the records made by Alfred Lukyanovich Yarbus who had worked out a special method for it. My associates and I managed to record the movements of the eyes of a flyer reading his instrument board in flight.

COURSE FOLLOWED BY THE EYES
WHEN FREELY EXAMINING
FOR 30 SEC



DRAWING AND

WHEN EXAMINING
THE OUTLINES



The record of the eye movements while reading a book reveals a good deal that is interesting. It turns out that, while looking at one word, the reader at the same time sees with his peripheral vision a few of the following words, which enables him more quickly to understand what he is reading and to grasp the grammatical construction of the sentence. A flyer can also quite adequately grasp the readings of his instruments if he sees them with his peripheral vision.

While reading prose we fix our eyes on a line on the average of about 7 times and move our eyes back to what we have already read 1.5 times. Although lines of poetry are shorter, the eyes move over them and shift back while reading them almost twice as many times because it is more difficult to grasp their meaning.

Now read and see if you can make out the following two paragraphs.

When any experienced reader quickly runs his eyes over the lines of a printed text, would it be correct to conclude that all parts of the letters and words are of equal importance or that some of them possibly leave a greater imprint in the reader's consciousness than do the others? Most readers will probably be inclined to assert that all elements of the outlines perceived by them are of about equal importance.

But there is an experiment to prove that this is not so. It usually takes longer to read the words of which only the lower halves of the letters are seen than when only their upper halves are left. The upper halves of the letters produce a greater impression, i.e., carry more meaning than do the lower halves.

Th mos essent par of wor ar act the begin an en ,
th begin carry mo mean tha th en . How , it is
mu mor diffic to rea word onl by thei beginn or
end tha by thei uppe or low halv ; and the read
will probab nee mor tim to rea eac of the tw tha
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etent and rienced ders an ead a umn of 50 tically
nged ters in about 15.5 onds. ey an so ead 50 our-
ter rds in 17 ons nd 50 ght- ter rds in out 19.5
onds. t s parently ot essary to al ead ters or ery rd as
a ole.

TRY TO READ THIS

When any experienced reader quickly runs his eyes over the lines of a printed text, would it be correct to conclude that all parts of the letters and words are of equal importance or that some of them possibly leave a greater imprint in the reader's consciousness than do the others? Most readers will probably be inclined to assert that all elements of the outlines perceived by them are of about equal importance.

But there is an experiment to prove that this is not so. It usually takes longer to read the words of which only the lower halves of the letters are seen than when only their upper halves are left. The upper halves of the letters produce a greater impression, i.e., carry more meaning than do the lower halves.

The most essential parts of words are actually their beginnings and ends, the beginnings carrying more meaning than the ends. However, it is much

more difficult to read words only by their beginnings or ends than by their upper or lower halves, and the reader will probably need more time to read each of these two than the former two paragraphs.

Competent and experienced readers can read a column of 50 vertically arranged letters in about 15.5 seconds. They can also read 50 four-letter words in 17 seconds and 50 eight-letter words in about 19.5 seconds. It is apparently not necessary to read all letters or every word as a whole.

LENIN'S READING

During a boat-ride along one of the Siberian rivers Lenin's companion watched him read. Lenin had some serious book in his hands and kept turning new pages in little short of 30 seconds. His companion wanted to know whether he read every line or merely ran his eyes over the pages. Lenin, somewhat surprised at the question, answered with a smile:

"Of course, I read every line; and I do so very carefully because the book is worth it."

When a child begins to learn he reads aloud, and all his attention is spent on translating visual perceptions into sound. And this is precisely what gives him pleasure. It therefore sometimes happens that the child has read a whole little story aloud, but has failed to understand it and cannot recount it. Only gradually does the child learn to read to himself. But even a well-reading adult can sometimes be observed to move his lips and whisper the words.

People who usually read to themselves, if asked to read aloud, seem to go back to a very early stage of learning to read and therefore find it difficult to understand what they read.

Try to read aloud and you will soon find that it has become somewhat more difficult to follow the meaning.

You can learn to read by seeing at once not only a whole line but sometimes even several lines or a paragraph, grasping the main words in them and recomposing whole ideas by them. That is the way Lenin read.

But such selective reading is possible only on the basis of excellent continuous reading and is the result of extensive experience of selective perception in reading.

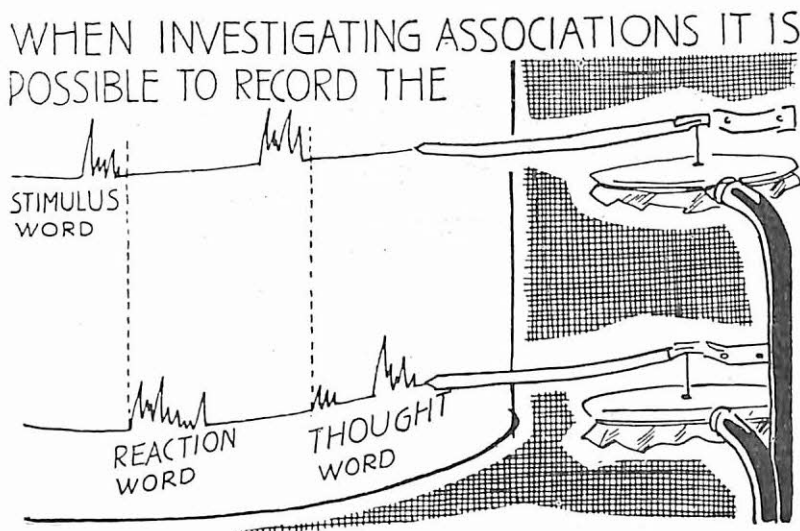
DERMOLEXY

Ask someone to draw a letter on the palm of your hand with a thin stick, say, a matchstick. You will very easily be able to tell the letter with your eyes shut. It is harder, however, to tell the letter thus drawn on the back or on the abdomen.

This dermolexy (*dermo* = skin, and *lexy*—from the Greek *lexikos* = of or for words) is one of the methods of speech among deaf-mutes. Dermolexy confirms that in addition to visual and auditory analysers man's second signalling system is also connected with other analysers.

THOUGHT WRITES

By accompanying the study of associations (pp. 149-50) with a direct recording of the subject's answers one can discover interesting phenomena. It is possible by means of a pneumatic capsule attached to the upper part of the neck to record the movements of the larynx or by means of electrodes to record the potentials arising in the tongue and larynx during their slightest movements. In these cases the association time is sometimes very much prolonged, while the curve already shows a record of the word which the subject had thought long before he said it.



The potentials of the muscles of the larynx and tongue may be recorded at the moment the person is solving a problem in his mind or is recalling something. But this does not always succeed since even in conversation we often omit words or build sentences regardless of the laws of grammar, often simplifying and curtailing our speech. Internal speech is, as a rule, even more curtailed.

WORK ON THE WORD

*Poetry's like the mining of radium:
Grams extracted by years of work.
For a single word you go straining and grading
Whole mountains of empty linguistic dirt.*

These words belonging to the Soviet poet Vladimir Mayakovsky very precisely show the work on the word not only in poetry, but also in any sphere connected with written speech. Look at the rough copy of Pushkin's lines in which the poet searched for the words which may best express his thought.

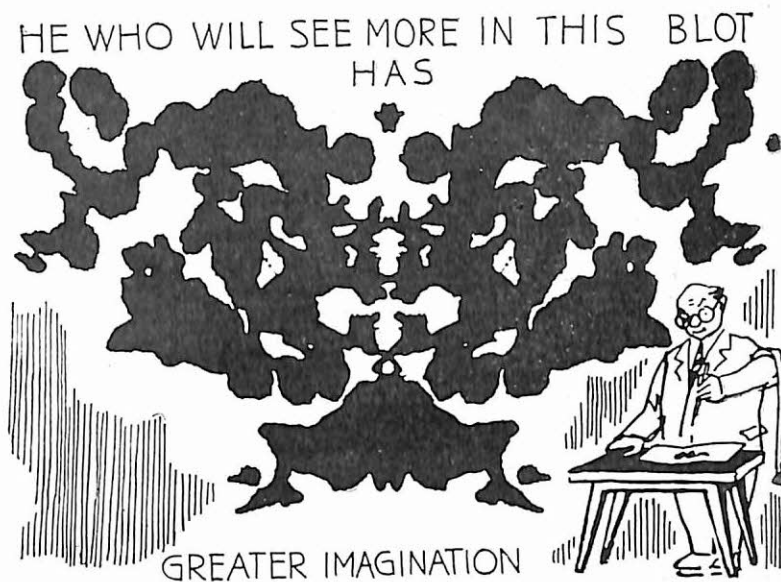
Lev Tolstoi rewrote some chapters of his novels ten times and more.

That was the way brilliant masters of the word had to work on it. You, too, my Dear Readers, would do well to be as serious about your language when you have to put your thoughts down in writing.

PUSHKIN THUS SEARCHED
FOR REQUISITE WORDS

[illegible]

ROUGH COPY OF AN EXCERPT FROM
Y E V G E N I O N E G I N



FORTUNE-TELLING

Look at the blot shown in the picture, or, better still, try to make some blots yourself. To do this, fold a sheet of paper in half, drop some ink inside the fold, close the two halves of the sheet and with your finger rub the surface of the paper above the ink to spread it as much as possible. After spoiling a few sheets of paper you will learn to make remarkable blots. But do not forget to spread a newspaper under the sheet on which you are making them.

Now what do the blots make you think of? Put the same question to your friends and relatives. The richer your fantasy, the more you will see in the blots.

This is the way our grandmothers used to tell their fortunes; they would melt wax and throw it into water, then, turning the lumps of wax in various directions and viewing its shadow on the wall, they "saw" carriage-and-threes with bridegrooms, bridal wreaths, death with a scythe, coffins and various monsters. They saw either what they wanted to see or, on the contrary, what they were afraid to see.

INSPIRATION

*And I forget the world in the sweet silence,
While I am lulled by fancy, and once more
The soul oppressed with the old lyric fever
Trembles, reverberates, and seeks to pour
Its burden freely forth, and as though dreaming
I watch the children that my vision bore,
And I am host to the invisible throngs
Who fill my reveries and build my songs.
And thoughts stir bravely in my head, and rhymes
Run forth to meet them on light feet, and fingers
Reach for the pen, and the good quill betimes
Asks for the foolscap. Wait: the verses follow.*

A. S. Pushkin thus described the psychological essence of creative work and inspiration.

Inspiration is an upsurge of a person's powers and abilities in the process of his creative work; it is characterised by mental clarity and is connected with a stream of thought and images, quick and highly productive thinking.

Maxim Gorky was right when he wrote that "inspiration usually comes in the process of persistent and strenuous work. It is erroneously considered a work stimulant. It probably appears in the process of successful work, as its effect." But Pushkin does not say that inspiration ends as soon as the first thoughts are committed to paper. Not at all! All of the subsequent work of improving the original variant may proceed with a continuously increasing upsurge. Pyotr Ilyich Chaikovsky said that inspiration is a visitor that does not like to come to lazy people.

However, inspiration cannot be severed from the need for creative work. Mozart said that "he who has the soul of a composer writes music because he cannot help writing it."

Inspiration is also connected with fantasy. Lenin wrote that "it is a mistake to think that only poets need fantasy. It is a foolish prejudice. Fantasy is needed even in mathematics; even the discovery of differential and integral calculus would have been impossible without fantasy. Fantasy is a most valuable quality".

Fantasy is a particular case of imagination, while imagination is a mental process consisting of creating new images on the basis of elaborating past perceptions. However strange the images of fantasy may be they always group together what was known before: for example, a hut on chicken legs, a sphynx—a winged lion with a woman's face, a centaur—a horse with the head, trunk and arms of a man.

WITHOUT IMAGINATION
THERE IS NO INSPIRATION



A N I M A L P A I N T E R

Not a single artist could produce anything without fantasy, for fantasy helps to imagine what cannot be directly perceived.

"An electron is as many times smaller than a speck of dust, as a speck of dust is smaller than—what would you think?—the earth," wrote Perelman.

"Imagine a diamond cube each facet of which is as wide as the Ganges. A raven comes to this cube once in a thousand years and cleans its bill on it. The diamond is gradually worn out. The time which it will take the raven to wear out the diamond until not even a grain of it is left is only an instant in eternity." That is how an ancient Indian philosopher explained to his pupils the idea of eternity as distinct from infinity.

HARMFUL AND HELPFUL WORDS

We shall let Pavlov say what the word "word" means. He defines it as follows:

"For man a word is as real a conditioned stimulus as all the other stimuli common to man and animals, and at the same time it embraces more than any other stimuli, and in this respect is beyond any quantitative and qualitative comparison with the conditioned stimuli of animals. Owing to all of man's preceding life the word is connected with all the external and internal stimuli reaching the cerebral hemispheres, signals them all, replaces them all, and can therefore evoke all the activities, the reactions of the organism which are conditioned by these stimuli."

The saying that "a word can kill" is a good warning, and it is therefore necessary to use words carefully. The more the hearers trust the speaker, the more vivid the emotional colouring of the words they perceive and the stronger their action. A physician enjoys the trust of the patient, the teacher is trusted by the pupil, and that is why they must choose their words with particular care.

Unfortunately there are still, though infrequently, cases of so-called iatrogeny (from the Greek words *iatros*-physician, and *genesthai*-to be produced), i.e., diseases induced by a physician's careless words. The following is an authentic case. Wishing to reassure an old woman who came for consultation, a young physician said:

"We will both die the same day, grandma."

After a while the old woman revisited the polyclinic and, learning that the young physician had suddenly died, was sincerely surprised.

"Then how come I am still alive?" she asked and dropped dead.

Often, after a physician asks the patient, "Does it hurt here?" and applies palpable pressure at the particular site, the pain becomes consolidated and actually begins to discomfort the patient, although there was no pain there before, nor was there any reason for it to appear there.

Pedagogical practice knows so-called didactogenies (from the Greek *didaktikos*-apt at teaching). I observed a case of a flying student who had always felt good and confident in flight, but suddenly began to experience unconquerable fear in the "spin". The reason for it was a note left for him by his instructor when the latter departed. The note read: "Hope to see you soon, but be careful in the spins."

We have already discussed hypnosis. And you know that a word can produce, as well as cure disease. Treatment by word-logotherapy-is part of psychotherapy, using the therapeutic influence of words. Of course, psychotherapy is used in combination with other methods of treatment-drugs and physiotherapy, and when necessary, with surgical intervention.

There have been cases where the patient had been ineffectively treated for years before administration of psychotherapy and was cured after its

administration. Cases of sudden cure were known to all peoples and in all ages, but formerly they were explained by the effects of "holy places" and "miracle-working icons". The patients were actually treated by the word of the priests who could make proper use of it, and the patients' faith in "miracles".

But the word can not only treat diseases. A poor flying student who was learning to fly in my group suddenly seemed to become regenerated and began to fly well. It turned out that he had accidentally heard his instructor express confidence in his flying ability.

HOW DID HE KNOW?

Unlike the logical problems which require only good thinking, the problems given below illustrate certain properties of thinking.

Two persons who had been friends in childhood met and had the following dialogue:

"I haven't seen you or heard about you in ages," said one of them.

"Sure, I even have a daughter now," the other one rejoined.

"What is her name?"

"Same as her mother's."

"How old is little Helen, then?"

Think about it, read this to your friends and ask them to tell you how the man knew that the name of his friend's daughter was Helen if they had not seen each other and had not known about each other since childhood.

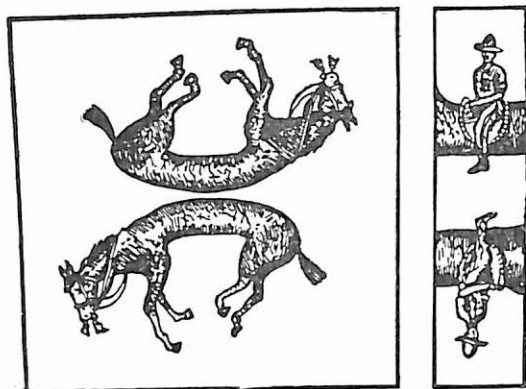
To prevent you from reading the answer to this with your peripheral vision before you have thought over the problem yourself, I wrote the answer at the end of one of the subsequent stories where I also explain the psychological import of this and the next stories.

CROSSING A RIVER

Two men wanted to cross a river, but the boat they found on the bank could carry only one. Both of them crossed the river just the same. How did they do it?

INERTNESS OF THINKING

Ask anybody what two months in succession have 31 days each, and most people will call July and August. Very few will ever mention two other months—December and January.



PLACE THE STRIP WITH THE RIDERS
SO THAT THEY ARE BOTH ON HORSEBACK

Try yourself and then ask others to try to connect 4 points located at the angles of a square by three straight lines coming back to the initial point without taking the pencil off the paper, to connect nine points arranged in three rows at equal distances by four straight lines also without taking the pencil off the paper, and to build with six matches four equilateral triangles with sides the length of the matches.

To solve all these problems, as also many analogous problems encountered in life, one

must be able to overcome one's inertness of thinking and use a new non-routine approach.

Everybody is used to beginning the year with January and ending it with December. The second correct answer to the first question will most commonly be given by school people whose year begins in September, while December and January are in the middle of the school year.

To solve the problem with the riders shown in the picture (p. 168), one must be able to do away with the idea of indivisibility of the pictured horses and of the necessity of putting the riders precisely on the backs of these and not other horses. The horses on whose backs the riders can be placed will have fore-legs of one of the pictured horses and hind legs of the other. The same principle must be adhered to in the problems with the points and lines. Here one must go beyond the given points, as is shown in our illustration. The triangles must be built not in one plane, but as a pyramid.

It is for the same reason that to many people it does not at once occur that little Helen's mother is one of the two childhood friends described in "How Did He Know?". The sentence "two persons who had been friends in childhood met" is conventionally taken to mean that the two friends were men, and hence the difficulty of solving the problem.

The problem with the river-crossing is rendered difficult by the first conventionally understood sentence, since it is easier to think of the two men on the same river bank, which, however, was not the case, for each of them had come to the opposite bank and crossed the river separately—first one and then the other.

HOW WE MUST NOT ARGUE

A few people were arguing about the role of induction in... , although it is no longer important in what. I observed, however, that the people who argued did not understand each other, and I therefore suggested that they first define the term "induction".

"In psychology induction implies the process of reasoning from the single or particular to the general," said one of them—a young teacher.

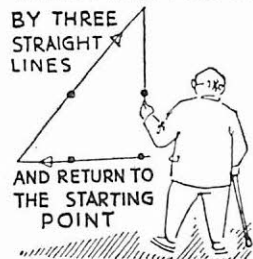
"I am speaking about the physiologic concept of induction in higher nervous activity, i.e., the interaction of the processes of excitation and inhibition in the cerebral cortex. If a zone of inhibition is created around the area of concentrated excitation, it will be negative induction, and if a zone of excitation is created around an area of concentrated inhibition, it will be positive induction. That is precisely how I. P. Pavlov understood induction," was the heated rejoinder of the one who was a medical student.

"In electricity induction or, to be exact, electromagnetic induction implies the Faraday-discovered appearance of an electromotive force in a circuit when it is crossed by a magnetic field. And that is what I have been saying," stated the person who was an electrical engineer.

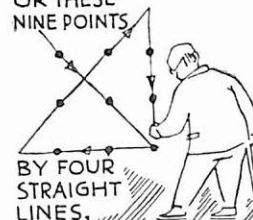
When the three of them understood that each had argued from his own professional point of view they had a good laugh. The definitions accepted in each branch of knowledge—psychology, physiology and electricity—were given correctly, but the trouble was that each of the arguing persons erroneously assumed that the term "induction" meant the same thing to his opponents.

Essentially there is no point in arguments of this sort since they cannot engender the truth, but this is unfortunately the way people often argue. For example. A. utters a few sentences which may not very precisely express his thought, and his interlocutor B. understands them in his own (B's) way. Here we already have 3 thoughts which should be similar, but are actually different. Let us assume that B. has also unhappily formulated his answer, and A. has naturally failed to understand him as he should have. We now have six thoughts of which only two agree—the thought that B. understood and the

TO CONNECT
THESE FOUR POINTS
BY THREE
STRAIGHT
LINES



OR THESE
NINE POINTS



IT IS NECESSARY
TO OVERCOME
THE INERTNESS OF THINKING
AND GO OUTSIDE
THE GIVEN DRAWING

thought he wanted to express. Now, if C. also joins in the argument, of the 12 thoughts only 2 pairs will be able to agree. Imagine the resultant chaos!

Indian philosophers have long since understood the futility of such arguments and have introduced the following rule. Before trying to disprove the thought of his opponent in argument each arguer must first state this thought and proceed with his own arguments only after receiving confirmation that he has correctly understood his opponent. The opponent must repeat the essence of the objections and after receiving confirmation of their correctness may proceed with his counter-objections.

It is a good idea to follow this rule, if not always, at least sometimes and, by all means when it is suspected that the arguers attach different meanings to the same words.

We must argue not about words, but about the concepts they stand for.

SCEPTICS AND PESSIMISTS

When at the dispute entitled "The Time and I", which opened the discussion club of the newspaper *Komsomolskaya Pravda*, someone called Zakhar Lipshits a sceptic, the latter took offence and almost all those present appreciated his taking offence. But critical thinking is an important quality and it is very good when it becomes a property of the personality, a trait of the character. Ancient Greek philosophers who were highly esteemed by Karl Marx for the critical character of their judgements were called sceptics. The name of this school of philosophy stems from the Greek verb *skeptikos* meaning "I look about myself", and figuratively—"I am pondering" and "I am doubting". It is good to ponder and doubt.

The *Komsomolskaya Pravda* dated April 5, 1961, and the 39th volume of the *Big Soviet Encyclopedia* which my neighbour held in his hands convincingly proved that he himself "pondered and doubted".

"If, while reading the *Encyclopedia*, you had not stopped at the first paragraph," I said to him, "you would have learned that in philosophy (in the 18th century) scepticism became reactionary agnosticism which alleged that science was incapable of cognising the true essence of things. As a mental characteristic scepticism is a predominance of doubts over pondering and critical ascertainment. And this is what you, too, have partly manifested by beginning, but not finishing, to read the book on the question you are interested in. As a trait of the personality scepticism is usually connected with pessimism—unbelief in the future with a predominant mood of melancholy, hopelessness and inclination to see only the bad and unpleasant sides of everything."

Scepticism and pessimism are engendered by absence of any prospects and are therefore characteristic of the world outlook of obsolescent, reactionary classes. The tragedy of Remarque's characters is that they see no prospects.

The communist world outlook is optimistic because it is based on knowledge of objective development of society and on confidence in the future.

However, optimism may assume the ugly form of varnishing reality, while scepticism in the best sense of the word, the scepticism to which the adjective "healthy" is added, although it would be best to say "active" scepticism, is a very important quality of thinking and the personality, i.e., criticalness. And Marx praised the ancient sceptics because they took nothing for granted and required proof of everything.

But even this quality of thinking, absolutely indispensable in scientific research or, for example, in the work of a legal examiner, may become a negative quality of the personality if it begins to determine one's relations with people. Mistrust easily develops into suspicion, and suspicion is akin to pessimism.

One may be mistaken in a person, but this does not mean that people must not be trusted.

COLLECTIVE THINKING

I. P. Pavlov thus characterised the chats with his associates now known in science as "Pavlovian Wednesdays".

According to a popular saying, two heads are better than one. Does it mean, then, that collective thinking is a mere addition of the opinions of several people? No, it does not. Psychologically it is much more complicated.

"A collective is possible only provided it unites people in activities which are clearly beneficial to society," said Makarenko.*

Collective thinking about some question, for example, by a work team exerts a positive influence on the thinking of each of its members for the following reasons:

the purposefulness in the solution of the common problem which the collective is pondering is mutually strengthened;

it offers a possibility to think about the problem from various angles and at the same time with self-criticism;

the exchange of opinions enriches the knowledge and experience of each member of the collective;

it stimulates initiative;

* A. S. Makarenko (1888-1939), outstanding Soviet teacher and writer.—Ed.

it gives rise to a feeling of emulation and mutual aid; collective settlement of one question stimulates the members of the collective to pose new problems.

Nor is this all. When a person thinks about something "for the twentieth time" his thought often runs the same course as many times, the working parts of the brain and the connections remaining the same. And when a person expresses his thoughts he hears them himself, which brings new parts of the brain into action and evokes new associations. It is not without reason that people say: I explained it to him once, explained it twice, and at last understood it all myself.

HAPPY RUSE

The conference could not come to an agreement. Each participant argued, insisting on his own proposal which he somehow substantiated. Feelings ran high, but no progress was made. Then a friend of mine who presided at the conference and was a good psychologist and lover of experiments suggested an intermission to air the premises.

When everybody returned to his office after the intermission he said:

"Let us once more hear all the proposals, their substantiation and the objections to them." And he turned on the tape-recorder which had imperceptibly recorded all the arguments of the participants.

One should have seen the faces with which the speakers heard out their own speeches and remarks which had sounded so clear and convincing to them before.

"Well, let's continue our discussions," said the chairman, changing the tape and turning on the tape-recorder demonstratively.

Well thought-out and clearer formulations enabled the conference to arrive at a correct solution of the problem to the satisfaction of all concerned. It should be noted that all the subsequent conferences taking place in my friend's office proved more productive because, fearing lest the tape-recorder be turned on again, all the participants tried to speak briefly, with good reason and responsibility.

CURIOUS OR INQUISITIVE?

There was a time when I was sure that science grew out of curiosity, but growing older I understood that science and art are based on man's need for knowledge. Coming to know a particular phenomenon man can master it and make it serve him.

But psychologically the need for knowledge is based on wonder. Neither primitive man nor child who are unable to wonder will strive for knowledge or will try to picture that which excites other people's wonder. The biological roots of this need are the orienting reflex which is in some measure characteristic also of animals. As I have already said it, Pavlov very aptly called it the "what is it?" reflex. In animals it is biologically deeply purposeful as it safeguards them against danger.

Whistle, and a drowsing puppy, who as yet has very little personal experience, will immediately prick up its ears. The "what is it" reflex is unconditioned. It also underlies involuntary attention, curiosity and inquisitiveness. Many conditioned orienting reflexes are formed on its basis in man and animals.

Curiosity and inquisitiveness are both manifestations of man's need for knowledge. In this they agree. But the striving for knowledge in curiosity has no aim; it is its own aim—to look in order to see, to learn in order to know. Curiosity therefore does not benefit man, does not enrich him. Satisfied curiosity extinguishes the striving for further knowledge.

But inquisitiveness is purposeful. In striving to satisfy his inquisitiveness man always understands why he wants to know something. Inquisitiveness therefore enriches man's experience, and that which is comprehended opens up prospects for further knowledge.

But inquisitiveness may also have different aims. What, do you suppose, guides the eternally whispering philistine and gossip in her striving to overhear what her neighbours say—curiosity or inquisitiveness? Inquisitiveness, of course. She eavesdrops in order to be able to poison the lives of her neighbours with her gossip and to consolidate her reputation of a well-"informed" person. It is therefore not inquisitiveness itself, but the aims to which it is subordinated that determine its value.

It was not curiosity that has given rise to inquisitiveness, but, on the contrary, curiosity is inquisitiveness that has lost its aim. It may be stated briefly: curiosity is aimless inquisitiveness. But, if this be so, it is not very difficult to make a curious person inquisitive. He must be helped to find aims for his striving for knowledge, which has assumed the ugly form of curiosity. But this does not mean that we must draw too sharp a line between curiosity and inquisitiveness, for a curious person is still better than a person who is not interested in anything, especially if it is a young person.

If in trying to find the "fourth superfluous" on p. 146 or to solve the riddles on pp. 168-69 you looked for the answers before attempting to work them out yourself it is possible that curiosity is one of your character traits.

AN ILLUSION THE AUTHOR WOULD NOT LIKE TO CREATE

Some of the readers of this book will probably develop the illusion that they have not only understood everything the author said in it, but that they may now even boast of being well versed in psychology.

Psychology As You May Like It is not supposed to take the place of a systematic course in psychology, which must underlie the study of this science, but the illusion when one series of comprehended particular questions creates the impression of knowing the entire scope of problems is a natural thing. It is often typical of quick-witted, but superficial person. A person of little culture does not know the extent of his ignorance because he is unaware of the achievements he could make by a deep study of science. This illusion is the psychological basis of dilettantism, the substitution of fragments of knowledge for a system of concepts.

The volume of knowledge accumulated by mankind is so great that not a single person can know everything. But it is very bad when a person becomes a kind of specialist whom Kozma Prutkov likened to a swollen cheek because his fullness is one-sided. The well-known Russian naturalist K. A. Timiryazev (1843-1920) has long since given us the formula which safeguards against dilettantism and one-sided education. He said that one must know a little about everything and everything about a little.

And yet, what can a person who has chosen to become a psychologist and has made a study of psychology do?

Such a person may, in addition to teaching psychology, do research in one of its branches. And there are quite a few of them, for example, psychology of labour, sports, art, general psychology, educational psychology, zoopsychology, child psychology, medical, military, engineering, legal, social and aviation psychology. Space psychology is now coming into existence before our very eyes.

Refining its own system of concepts each of these branches serves to enrich the general science of psychology, while contributing to practice in its own field.

WHO IS SMARTER?

Popular wisdom has created many fairy tales about simple-minded Johnny (every people has its Johnny) who in the end proves smarter than his practical, but hidebound brothers. Intelligence is man's ability to think and regulate his relations with reality.

Thinking has both positive and negative qualities. The positive qualities include criticalness, versatility, breadth, depth and rapidity. Initiative is

determined by active and critical thinking. Initiative combined with rapid and broad thinking makes for resourcefulness, while resourcefulness combined with a special quality of memory—its readiness—we call quick-wittedness. Popular fairy tales always endow their positive characters with resourcefulness and quick-wittedness.

The negative qualities of thinking are narrow-mindedness, triteness, superficiality and slowness. Intelligence is a quality of the personality, manifesting peculiarities characteristic of this personality's thinking.

Some people live by their intelligence, others—by their feelings. Which is better?

That depends on who does what. You can't do very much in science with feelings alone. Science needs rationalism and sometimes even scepticism, whereas art requires feelings. But... "without 'human emotions' there has never been, nor can there be any human *quest* of truth," said Lenin. Absorption in one's work is one of the most important characteristics not only of artists and thinkers, but also of every person in general, whereas rationalism, which is so necessary in science and engineering, easily develops into excessive prudence in human intercourse; this quality may be useful for a business manager, but cannot be accepted as a principle of morality.

Man's experience is enormously important in the field of his endeavours where he has to use his intelligence and resourcefulness, as well as in related fields which may be utilised in his work. A person may be clever in one field and none too clever in another. The great educator and psychologist K. D. Ushinsky said that intelligence "is a well organised system of knowledge".

According to Lenin, "not he is intelligent who makes no mistakes. There are no such people, nor can there be any. He is intelligent who does not make very serious mistakes and who can easily and quickly correct them."

And now do not forget to reread the definitions of thinking on p. 143 and of concept on p. 145. I am sure you will now gain a better understanding of them.

Does this mean that you have grown more intelligent? Of course, it does. Empedocles, Greek materialist philosopher (490-430 B.C.) who reduced all the multifariousness of things to four elements—earth, water, air and fire—properly taught that "human intelligence grows in accordance with man's cognition of the world".

"I"

What is "I"? How do I know that I am he who, when he was three years old, lived in a village and ran to the river to feed ducks, had been ill with whooping cough and went to school, and, one day, while skiing, fell off a cliff, and... Now I recall all this. But what is this "I" which is so different and yet the same?

This question has intrigued mankind for many thousands of years. Unable to answer it people have invented an immortal soul which is their "I" temporarily abiding in their mortal bodies. The body grew, changed, aged and died, but the "I" remained invariable. It was able to leave the body and fly away in dreams and could transmigrate to other people's or animals' bodies.

The formulation of the question contains its own answer, for the person who has asked it said all he could remember about himself. He could probably tell a good deal more, but is unable to do so indefinitely or even merely for a long time. The memoirs published in several volumes contain not only what the one who wrote them remembers about himself, but also what he has added to his recollections from various sources.

Try to call up from your memory the ideas and images you remember directly from your early childhood. There won't be so many of them. But you will be able to tell a lot more about yourself because you know a good deal from other people's words. Sometimes it is even hard to tell whether it was really thus, or you remember only what you have heard from others.

As a result of concussion of the brain a person may forget his mother tongue and his past. The patient with such retrograde amnesia says, "I know I am alive, but I don't know who I am." His "I" is no longer what it is in healthy people. A person's "I" is the continuity of his consciousness based on memory, while memory is the mental capacity of retaining and reviving impressions or of recalling or recognising previous experiences;

it is based on formation of sufficiently strong temporary connections in the cerebral cortex.

Ancient Greeks believed Mnemosyne, the goddess of memory, to be the mother of the Muses. Aeschylus (525-456 B.C.), great Greek dramatist, has his character, Prometheus, say the following:

*Hark, let me list all that I did for mortals:
I invented numbers,
Gave them letters to be linked in words,
And memory, the mother of all muses, source of all!*

The memory preserves not only what man has perceived, but also what he has thought. That is why man's "I" always reflects, usually somewhat lagging behind, but often also running ahead, the time in which he lives.

SPLIT PERSONALITY

Felide, a French girl, was sickly, reticent, melancholy and timid. After losing consciousness for a few minutes she would come to, a different person—gay, lively, coquettish and even thoughtless. Then, after a brief faint, she would again become what she had been before. The girl seemed to live two different lives, each time remembering everything connected with the given state and forgetting all that occurred in the other state. Preparing to become a mother in her second state she could not understand what was happening to her while she was in her first state.

Aware of her illness Felide learned, as time wore on, skilfully to adapt herself to it and to conceal it. One day, on her way home from a funeral, while in a carriage with women who had no inkling of her disease, she changed from one state to the other. With no idea why she was in mourning and what deceased person her companions were referring to she quickly grasped the situation by asking several leading questions and thus got out of the difficulty.

At the end of the last and at the beginning of the present century psychiatrists described some 20 cases of split personality; one boy even lived six different lives. These cases of memory diseases demonstrate the connections of our "I" with memory. In olden times such patients became victims of superstitions and quickly perished.

DID IT OR DIDN'T IT HAPPEN BEFORE?

"I was getting ready for my examinations and was very tired," a student told me. "Suddenly I began to feel very strange. Say, I was studying, or talking, or attending a lecture; it began to occur to me that what

was happening had already happened before in exactly the same way. But I knew very well, for example, that I had never attended that lecture before and hadn't even been in that lecture hall. I tried to persuade myself that it had not happened, but could not rid myself of the feeling that it had. Tell me, please, is this dangerous?"

I set his mind at rest. Psychiatrists know this symptom of feeling of familiarity, the so-called *déjà vu* (already seen), which usually occurs in overfatigue. This phenomenon often became a source of superstitions. Pious people thought that, although they had not been present at some past event, their souls must have been there. The soul had allegedly seen and experienced it all.

Such experiences occur when something really resembles past happenings, but a tired person does not understand it and begins to feel that all that had already happened before.

The best way to rid oneself of such sensations is to take a good rest.

RECOGNISED

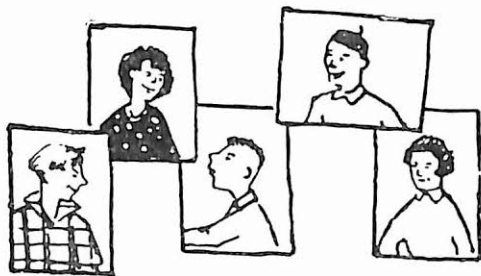
"Don't you recognise me?"

"I'm afraid I don't. Where have we met?"

"Remember in such and such town in 19...?"

"So that's you, is it?"

Such a dialogue can be heard quite often. Recognition is identification of that which is being perceived with that which was perceived before. It may vary in degree—from a vague feeling of familiarity with what is being



perceived to a complete certainty of identity. As in the foregoing dialogue, leading questions help recognition.

Show some of your friends the picture printed on page 178 and let them examine it for ten seconds while you keep the picture on the opposite page covered. Then cover this picture and ask them to recognise the faces shown in the picture on the opposite page. If you repeat the experiment with the same person, he will recognise a greater number of faces. This will be the result not only of the repeated perception of the picture, which helped him remember them, but also of his better understanding of the problem and his more active striving to solve it. It is always easier to remember the thing which, as we know, we shall be asked to identify.

Sometimes recognition may play a trick on you by creating the illusion of knowledge. A person recognises something, even imagines having seen it in a textbook—"at the top of the left page"—and thinks he knows it.

Knowledge and recognition are not at all the same.

An experiment in recognition may be conducted differently, with one's visual memory studied at the same time.

Prepare several sheets of paper with empty frames of the same size as in the picture on p. 178 and after looking at the faces on that page draw as many as you can from memory. Then take another look at the picture and add as many faces as you can; do this until you can draw them all. The scope of your visual memory, and the number of times you had to look at the picture until you completely memorised it will show the speed of your memorisation.

Several hours later or, better still, the next day draw again as many faces as you can remember and identify them by the picture. By comparing the precision of memorisation with that of recognition you will find the latter to be greater. If you repeat the attempt to reproduce and recognise the memorised faces at a later time, you will discover that the memory is longer in recognising than in recalling.

Scope, speed, precision and length are the basic qualities of memory, characterising its productivity.



IDENTIFY FACES FROM THE PRECEDING PICTURE

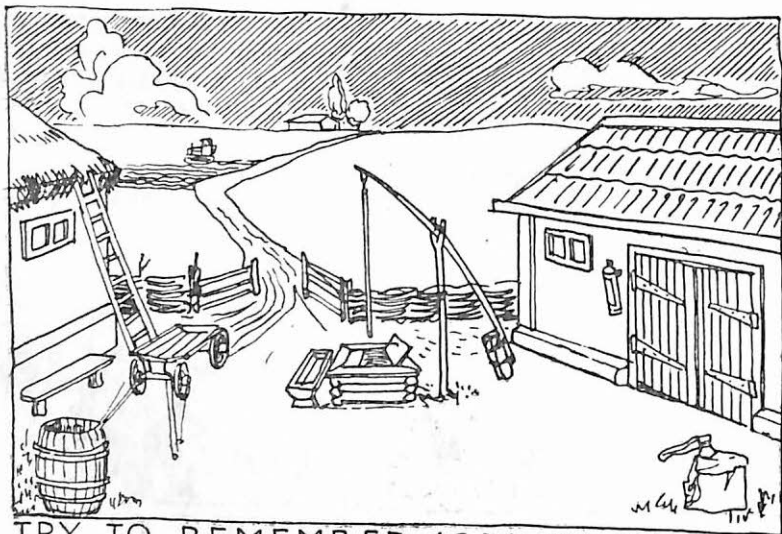
STOREHOUSE OF MEMORY

The story goes that, deciding to extend his education, one man started studying the *Encyclopedia* consecutively. He went only as far as the word "absurd" and could not get any farther. But even if he continued studying the *Encyclopedia* it would have done him no good since the *Encyclopedia* is a reference book, while education is based on a system of acquired knowledge.

The most important of all qualities determining the productivity of memory is its readiness, i.e., its ability to extract from the stock of memorised information precisely that which is needed at the moment. There are people who know a lot, but all their knowledge is a dead weight in their memory. When something has to be called to mind, what is needed is always forgotten and what is not needed "comes rushing into the head". Other people may know less, but their stock of information is always ready to hand and the memory always reproduces precisely what is needed.

Do you want me to give you some sound advice?

One cannot first generally learn something somehow and then develop the readiness of his memory. As a matter of fact, the readiness of memory



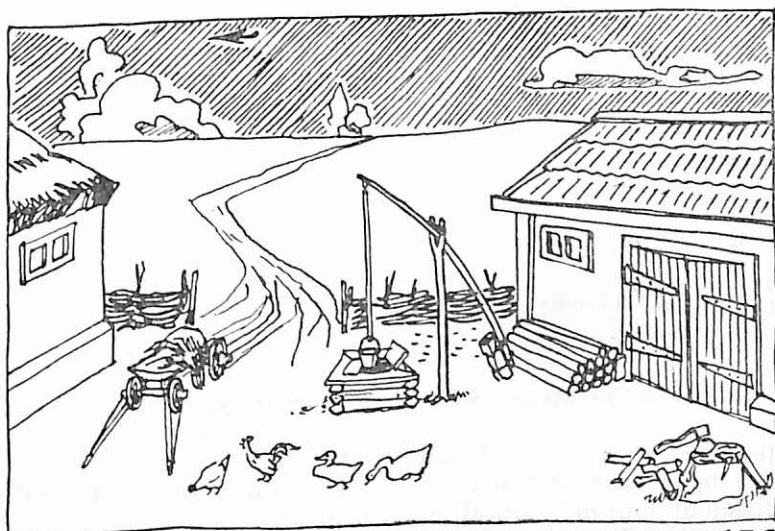
TRY TO REMEMBER AS MUCH OF WHAT
IS SHOWN IN THIS PICTURE AS YOU CAN

forms in the process of memorisation which must necessarily have certain meaning and during which associations are immediately formed between the material being memorised and the cases when this material may be needed.

While reading a historical novel and comparing what it describes with what is given in a textbook of history we are preparing the memory to be able to reproduce what we have read when a corresponding historical fact is discussed.

In the process of memorisation the material must necessarily be systematised. Of special importance here is the ability to find differences and similarities in things. "The memory is a storehouse of the mind, but it has many partitions and it is therefore necessary to store everything in its proper place," said Suvorov.* Napoleon used to say that all his affairs and knowledge were packed in his head as in a chest of drawers and that he could extract the necessary information by opening the appropriate drawer.

* Aleksander Vasiliyevich Suvorov (1730-1800), famous Russian soldier, generalissimo of the Russian army and one of the originators of the advanced Russian art of war.—Ed.



STATE FROM MEMORY THE DIFFERENCES
BETWEEN THIS PICTURE AND THAT ON THE
PRECEDING PAGE

Systematism in accumulation of knowledge helps more than anything else to develop the readiness of memory.

When committing anything to memory we must understand why we are doing it and in what cases we may need the particular information.

WHAT ARE THE DIFFERENCES?

Look for a period of one minute at the picture on p. 180 and try to remember as many things in it as you can. Then, after looking at the second picture, list on a sheet of paper in two columns what the second picture lacks compared with the first one, in the first column, and what the second picture has that the first one does not have, in the second column. While looking at one picture, you must cover up the other one. Then compare both pictures and check up on what you have failed to memorise.

By carrying out this experiment with your friends you can discover differences in their visual memory. In addition to visual memory the experiment will also show the keenness of observation and attention with which both pictures, especially the first one, are examined. It will likewise reveal apperception which we have already discussed.

Visual memory can be tested by modifying the "Indian Game" related on p. 135. To do this, the group of objects must be shown not for one second, but longer, say, for one minute, so that the subject may be able to see all objects and try better to memorise them. The subject should be questioned in several minutes or even after a longer period of time so that not only memorisation, but also forgetting may be tested. Repeating the game in this variant will develop visual memory.

HAVE YOU A GOOD MEMORY?

Read carefully, but only once, and try to remember the following figures:

64, 93, 57, 68, 46, 37, 39, 52, 74, 49

Now write down the figures you remember, if possible, in the order in which they are given.

The number of remembered figures will characterise the scope, and the number of figures which you wrote down in the proper order will reveal the precision of your mechanical visual memory.

If someone read a similar series of two-digit figures, you would be able to evaluate your mechanical auditory memory, and by comparing the results, establish your predominant type of memory—visual or auditory,

providing, of course, nothing made the results of these experiments fortuitous.

By reading or listening to some text and then writing down what has been memorised it is possible to evaluate not only mechanical, but also semantic memory.

But do not try to evaluate your memory by the results of one experiment. In the first place, the quality of memory is determined by many of its aspects; secondly, you may have a good mechanical and a very poor semantic memory and vice versa. Moreover, your memory may temporarily have diminished through fatigue, indisposition or even low spirits. Lastly, memory may be developed, and, poor today, it may become good, if not tomorrow, at least at some future time.

ON THE WAY TO WORK

A. A. Smirnov, well-known Soviet psychologist who studied the laws of memory for many years, devoted the main attention to voluntary semantic memory and the laws of its formation in schoolchildren. One day, however, he decided to study the question, from another aspect, namely, to see what man memorised incorrectly, since one must not underestimate involuntary memory.

He began asking his associates what they memorised while they were on their way to work. He asked each of them separately 1.5-2 hours after the beginning of work, and, of course, unexpectedly. And what do you think? The results proved simply amazing.

All those who were questioned could, in greater or lesser detail, tell what they *did* on their way to work. They remembered particularly well what had been in their way and had made things difficult for them. But not one of them could recall anything of what he *thought* on his way to work.

"This does not mean that thoughts are recalled with greater difficulty and that they disappear more quickly from the memory," Smirnov notes, "but it does mean that involuntary memory is associated with man's activity."

These experiments were repeated by other investigators and the results were invariably the same.

You, too, can easily check on them. And this is worth doing because this simple experiment will help you convince yourself that you cannot do one thing and memorise another.

To make memorisation productive, it must be included in corresponding activity.

DO YOU WANT TO MEMORISE THINGS BETTER?

One day while out walking we were all lost in admiration of a wonderful landscape.

"What a beautiful sight!" one of my companions exclaimed. "How I should like to remember it better! This way you look and look, and the moment you close your eyes only a colourless, vague and incomplete image of what you have seen rises in your memory."

To be sure, recollection always produces a paler and less complete image than perception. But, if you want to have a better memory of what you have seen, do the following. Take a good look at the landscape, close and open your eyes several times in succession, comparing what you see with what you imagine and each time your imagination will grow richer, more vivid and more distinct.

Suppose you have learned something new about a thing you have already seen. By linking the new information with the traces of your imagination you will be able to enrich the image. Sometimes you will even think that you had seen what you later learned.

We usually retain a poorer memory of a picture, sculpture, architectural structure, etc., if we see them alone than if we see them while listening to the explanations of a good excursion guide.

WITH NO KNOWLEDGE OF THE LANGUAGE

There is a well-known case of an illiterate woman who had fallen ill and, while delirious, very precisely quoted long excerpts from books in Greek and Hebrew—languages she did not know. When the patient came to, she was unable to explain it. It turned out that in the past she had served as a maid in the home of a pastor who had been in the habit of reading aloud his favourite Greek and Hebrew books. Various excerpts from what he had read had spontaneously impressed themselves on the woman's memory and were just as spontaneously reproduced in delirium.

This rare case indicates the possibility of analogous, less spectacular cases and helps better to understand the nature of memory.

QUOTATIONS AND QUOTATIONISM

The following dialogue took place in a lecture-hall. I asked a student: "Do you remember, as I asked you to, the particular sentence from my last lecture?"

"Of course, I remember it," the student answered with certainty. "You said, 'Day before yesterday an aircraft alighted here.'"

I could not help smiling and rejoined:

"I thought you might not remember some of the things as I said then, but I did not expect to hear entirely different words. I asked you to remember the sentence: 'The other day an airplane landed in this place.' You created a definite semantic image for yourself and it impressed itself precisely in your memory, but you could not remember a single word from the original sentence and you have replaced all of them with synonyms. Now judge for yourselves," I turned to the rest of the students, "how well he memorised the sentence."

"I think he memorised it very well," said one of the students. "You did not tell us to memorise the sentence word for word, and, as to the meaning, he reproduced it very precisely."

"If I start reciting poetry or playing my role with the same 'precision', they'll chase me out of the dramatic circle," a girl student retorted.

And both of them were right. Of course, poetry, as well as a role in a play, must be learned word for word, i.e., by heart, whereas in science and in general education semantic memorisation is more important because it is more effective. Verbatim memorisation without comprehension is actually cramming, while substitution of a verbatim account of other people's thoughts for one's own is quotationism.

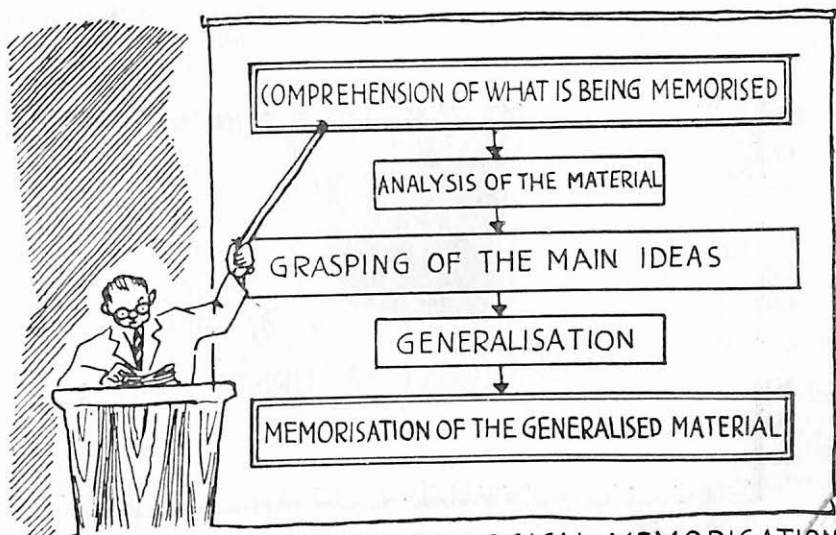


DIAGRAM OF THE STAGES OF LOGICAL MEMORISATION

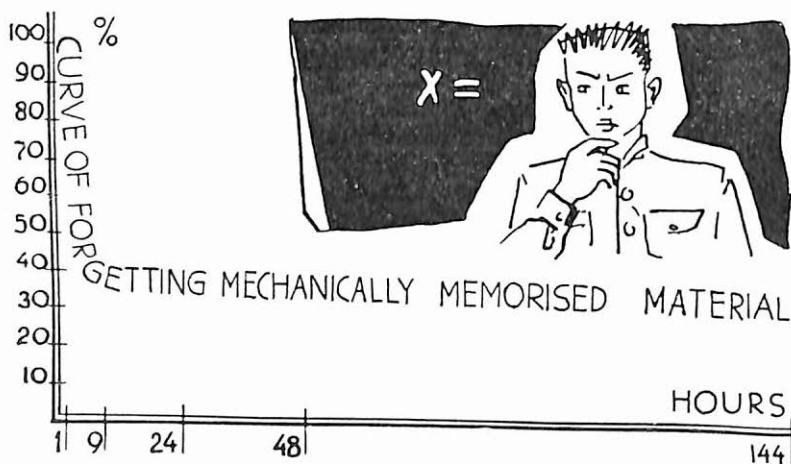


Semantic or logical memorisation is the result of a complex mental process. Its stages are diagrammatically shown in the illustration, although in life some of them actually overlap in time.

Of course, not all quoting is quotationism. Very often we quote word for word, rather than in our own words, not only poetry, but also the statements of the founders of Marxism-Leninism, statesmen and public figures, and the classics of science, literature and art. I, too, am doing it in this book. It is more interesting and useful for you to read and sometimes to reread their clear, precisely formulated thoughts than my account of them, which may have lost some of the finer points and shades. Of course, you will remember primarily the meaning of these original statements, but by memorising their meaning you will be closer to the original than if you read my account of them.

WHEN IT IS GOOD TO FORGET

This illustration shows how soon and what part of the learned material man forgets. Twenty-five per cent of what is memorised is forgotten within one day. This curve of mechanical memorisation and reproduction of uncomprehended material was obtained as early as 1885 by the German psychologist Herman Ebbinghaus. Semantic memory is about 25 times as productive as mechanical memory. The material memorised by its meaning is retained much longer, although, if it is not from time to time refreshed in the memory, it will also sooner or later be forgotten.



It must not be thought, however, that it is always good to remember things. At times we commit to memory a lot of entirely needless trifles which in the end encumber our memory, if they are not soon forgotten. Forgetting also rescues us from unpleasant memories and, what is even more important, helps us, by disregarding details, to retain the basic, generalised concepts and conclusions. We can comprehend and recount what we have read precisely because we are unable to memorise it verbatim by meaning.

I knew a person who never forgot anything. He was in a mental hospital. This patient was crushed by memories and could not express a single thought of his own. He reproduced verbatim long newspaper articles which had been read to him a few days previously and which he did not understand, but at the same time was unable to recount in his own words even a simple children's book.

A. R. Luria, whom I have already mentioned, studied for 30 years a certain man's amazing memory which was unlimited in scope and time.

This man easily memorised series of 100 figures, words or even meaningless syllables. He could reproduce them 10, 15 and even 20 years later. He memorised dissociated material better than a series of thoughts, but he had a very poor memory for faces.

"There is so much in faces that changes and is complicated," he said; "for example, the person smiles, he is in a different mood, and everything has broken up, changed, and I am at a loss and no longer know what I should devote my attention to."

But this man could not with any benefit use his phenomenal memory anywhere. He tried, for example, to work as a railway dispatcher and failed. As long as he lived he was able to demonstrate only on the variety stage his memory that never forgot anything.

LIES LIKE AN EYE-WITNESS

Several people have witnessed an accident, a very trifling one, to be sure. Ask each of them to describe it separately, and you will get an idea of how difficult is the work of an interrogator who questions witnesses; at the same time you will agree with the above heading.

The more emotions a particular episode evokes and the longer the time since it took place, the more will the eye-witness accounts differ.

The reader already knows the reasons for it, namely, selectivity of perception, apperception, and selectivity of memorisation and forgetting.

FISH STORIES

In evaluating the recollections of eyewitnesses and participants of various emotion-filled events it is necessary to remember one more factor, but here I shall resort to the aid of Lev Tolstoi.

"...He (Boris Trubetskoi—*Author*) asked Rostov to tell him where and how he had sustained his wound. This pleased Rostov and he began his tale, growing increasingly more animated as he proceeded. He told them about his Schönggraben affair precisely as people usually tell about battles they fought in, i.e., as they should like it to have been, as they heard other people tell it, as it is nicer to tell it, but absolutely unlike it was. Rostov was a truthful young man and he would never intentionally tell a lie. He had begun his story with the intention of telling everything exactly as it was, but imperceptibly, unwittingly and inevitably changed to untruth."

The excerpt from Tolstoi's novel *War and Peace*, which you have just read contains all the psychological essence of many so-called "fish stories". Sometimes such striving to tell the desired for the real (confabulation) is a symptom of pathologic development of the personality, a manifestation of disease.

Guided only by the desire to be in the centre of attention the confabulant invents fantastic stories about himself and his surroundings with no concern for the truth. Let us recall famous Tartarin de Tarascon or even Baron Münchhausen. Such persons cannot be called liars, however, for they believe their own stories.

IT WAS GOOD, THOUGH!

One day a group of us went motorboating. We went quite a distance from the shore and—alas and alack!—the motor went out of order; we had to row back. And, as luck would have it, it started raining. All of us got drenched and cold, we all became nervous and, I confess, a few even started wrangling. All in all our little outing proved quite a flop.

Many months passed, and there was no end to the pleasure, laughter and jokes with which we recalled our ill-starred boat ride.

This biologically expedient law of forgetting is one of the manifestations of selectivity of memory. The bad and the unpleasant is forgotten sooner and more completely than the good and the pleasant.

Man may memorise what he perceives with his visual and auditory memory, his movements with his motor memory, his thoughts with his logical memory, and his feelings with his emotional memory. Yes, there is also an emotional memory.

"If you are capable of paling or blushing when recalling an experience, if you shudder at the thought of a long past misfortune you have a memory for feelings or an emotional memory," said Konstantin Sergeyevich Stanislavsky.*

But, as we have already noted, the pleasant and the unpleasant are not equally remembered. If women remembered all the hardships of pregnancy and labour better than the joys of motherhood, scarcely any of them would want to have a second child, and the human race would long since have become extinct.

If people retained in their memories predominantly the unpleasant, they would expect nothing but trouble in life and would all be pessimists, but man is an optimist by nature.

But this law also has its negative aspect. The older generation often reproaches the younger generation, saying, "We were not like you; we were better than you." Sometimes it is true, but most commonly this, like the words

*Our grandsires used to live of old
Far merrier than we*

manifests the same law of selectivity of memory.

AGE ABOUT CHILDHOOD

This time my friends wanted to know why old people forget what happened yesterday, but very well remember what occurred when they were children.

To be sure, the things memorised in childhood are most firmly retained in memory and that is why old people usually have more vivid impressions of the distant past than of the recent period. In old age it is generally difficult to memorise anything new mechanically. Foreign languages are learned with greater difficulty at a ripe age than in childhood or youth.

The following is an authentic case. A gravely ill man was dying in a New York hospital. He had been born in Italy where he had spent his childhood; as a youth he had lived in France; then he had lived for a long time in the U.S.A. The interesting part of it is that at the onset of his illness he spoke English; when his condition changed for the worse he forgot English and started speaking French. On the day of his death he spoke only Italian.

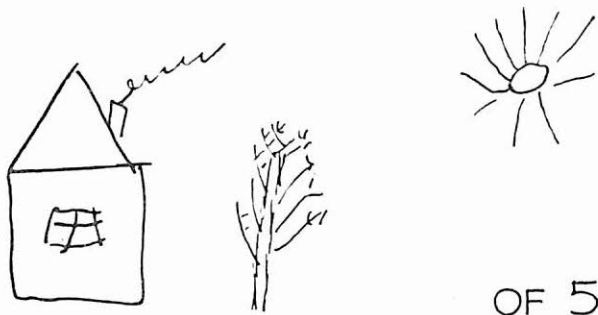
* K. S. Stanislavsky (1863-1938), most prominent Soviet theatrical producer and theoretician of theatrical art.—Ed.

But a weakening of the memory in old age is not at all inevitable. The memory of people doing mental work is well trained and is therefore often retained to a venerable age. The large number not only of scientists, but also artists, poets and narrators (of folk tales) may serve as an example of this.

HYPNOREPRODUCTION

A man sustained a contusion and was seriously ill. Severe attacks with loss of consciousness, spasms of the right arm and leg, and twitchings of the right half of the face tormented him for a period of four years. Of course, there were also other symptoms recorded in detail in his case history. He was cured and was perfectly well for nine years. There was not a trace of his illness. He even forgot about it.

PICTURES OF AN ADULT



OF 5

There was not a trace of his illness?! Wasn't there?

Nine years after he had been cured he chanced to meet his physician who had cured him. The latter brought him into a state of hypnosis and suggested to him: "Today is the day of your first visit to me. Now wake up."

And the man who had been perfectly well for nine years woke up as he had been before treatment. His condition completely corresponded to what had been recorded in his case history many years previously. Hypnosis was induced again and a corresponding suggestion was made: "Today is such and such day (the actual date), wake up," and he woke up a healthy person again.

This is not the only case of hypnoreproduction described by my father

K. I. Platonov in his monograph *The Word as a Physiologic and Therapeutic Factor*.

My pupil L. P. Grimak, a physician and parachutist who had made many parachute jumps, suggested to parachutists he had hypnotised that "today" is the day when the subject "prepared for the jump", "jumped" or "landed". Thus without leaving the room he studied by means of various instruments and methods of hypnorelease the psychology of the parachute jump. Hypnorelease helps to gain a better insight into the nature of memory, health and disease.

IT'S THE CAT'S FAULT

"A black cat crossed the road in front of me. I felt like turning right back. I know it's foolish, but I don't like it, and it makes me feel bad. Every time a black cat crossed my road I got poor marks at school. I even

"RETURNED" IN HYPNOSIS TO THE AGES



AND 10 YEARS

failed in my examination once. It seems funny to you, doesn't it, Professor?"—the woman who said these words was excited and embarrassed.

No, it didn't seem funny to me. I am a physician, and physicians do not laugh at their patients, but treat them. Superstition is also a sort of social disease. Sometimes it is mild, as that of my interlocutress, like a common cold, and sometimes terrible and taking a toll of many lives.

The cause of belief in omens is the selectivity of memory. Now and then we all received poor marks at school without having black cats cross our road, and very often received excellent marks after encountering this dreadful animal under the aforesaid fateful circumstances. But the latter passed without arresting our attention, whereas when a black cat coincided with a poor mark we always remembered it.

But this is a matter not only of selectivity of memory. Upon encountering a cat a superstitious person lost faith in his own powers. And that is why a schoolchild recited his lesson worse than he might, forgetting what he knew. Then he blamed the cat, i.e., declined all responsibility.

The origin of superstitions was well understood by the British materialist philosopher Francis Bacon who in 1620 wrote that, if we like to believe in something, we try to persuade others, although often the number of examples proving the opposite and their significance are much greater, but we either pay no attention to them or ignore them consciously, shut our eyes and stubbornly adhere to the pernicious prejudice defending at all costs our arbitrarily chosen opinion. Hence, as he justly maintained, it happens that in many superstitions, astrology, and interpretation of dreams, omens, etc., people who find pleasure in such nonsense always remember that which confirms their beliefs and neglect or disregard the cases which refute them, the cases which may be much more numerous.

Long before Bacon, Cicero (106-43 B.C.) wrote about a man who, when shown in a temple a picture of people saved from a shipwreck, allegedly because they had made a vow to the gods, and asked if he now recognised the power of the gods answered:

"And where is the picture of those who perished after making their vows?"

PHENOMENAL MEMORY

The brilliant physicist and mathematician Leonhard Euler had an unusual memory for numbers. He remembered, for example, the first six powers of all numbers up to 100.

In 1812 the attention of scientists was attracted by Zira Kolbern, an 8-year-old boy who could raise numbers in his mind to the 10th and even the 16th powers and extract roots. When asked how many minutes there are in 48 years he answered at once 25,228,800. Moreover, he immediately followed this by giving the absolutely correct number of seconds.

"I brought home in my head, in my memory, the entire background for the picture *Peter I and Tsarevich Alexei* with the fireplace, cornices, four pictures of the Dutch school, the chairs, floor and lighting; I had only been once in that room, purposely once, in order not to break up the impression I had gathered," wrote the Russian artist N. N. Ghe (1831-1894) about his picture in which he portrayed from memory with documentary precision a room of one of the Peterhof palaces.

Many examples of phenomenal musical memory are known. The Russian composer Mily Alexeyevich Balakirev heard one of Chaikovsky's symphonic compositions at a concert and two years later was able to reproduce it to its author precisely.

The following is an amusing episode from Sergei Vasilyevich Rakhmaninov's creative biography, which characterises his musical memory. One day composer Aleksander Konstantinovich Glazunov was supposed to visit Rakhmaninov's teacher Sergei Ivanovich Taneyev and play his new, just finished symphony which was not known to anybody. Wishing to play a trick on Glazunov, Taneyev hid Rakhmaninov in the bedroom before Glazunov's arrival; at that time Rakhmaninov was still a conservatoire student. After Glazunov had played his symphony Taneyev brought out Rakhmaninov who sat down at the piano and reproduced the whole symphony. Glazunov was puzzled: how could a conservatoire student come to know a composition whose score he hadn't as yet shown to anybody?

MNEMONICS

At an amateur-talent soirée one of its participants was particularly successful. His stunt consisted in the following: he asked those present to call individually and not very quickly some word and to remember or even write down the ordinal number of his (or her) word. Forty-eight people called 48 words, after which he asked them to call their words at random and, as they did so, he told them the ordinal number of each word. Following this he asked them to call their ordinal numbers at random and told them the words (true, he made one mistake).

The secret of his memory was simple. While still a child this man memorised some 50 words and associated definite numbers with them, for example, chair-1, table-2, street-3, etc. When anybody called a word he immediately associated a certain sentence with the word he had to remember. The first person called the word "piano" and he at once made the following association: "One plays the piano while sitting on a stool." The third person called the word "trousers", and he formed the association: "To show himself in the street, a man must wear trousers."

When the word "piano" was later called he had no difficulty recalling the word "chair" he had associated with "piano" and that the word "chair" was No. 1 he had very well known for a long time. He similarly recalled words by numbers. For example, when No. 3 was mentioned he knew that it stood for "street" and easily recalled the word "trousers".

The foregoing is an example of using so-called mnemonics—special artificial methods of memorisation, making use of associative memory. It will be remembered that Mnemosyne was the Greek goddess of memory. Many mnemonic methods could be cited, but we shall cite only two. The first is used by American medical students to memorise the 12 pairs of cranial nerves:

I	II	III	IV	V	VI
On	one	Olympus'	tiny	top	a
Olfactory	Optic	Oculomotor	Trochlear	Trigeminal	Abducens
VII	VIII	IX	X	XI	XII
Finn	and	German	viewed	a	hop
Facial	Acoustic	Glossopharyngeal	Vagus	Accessory	Hypoglossal

The second method is used by Russian schoolchildren to memorise the dates of birth of Russian classics, for example: Pushkin was born one year before the 19th century, Gogol was 10 years younger than Pushkin, and Lermontov was 5 years younger than Gogol; he was born in 1814 and died in 1841 (14-41). Turgenev was born in 1818 (18-18).

Mnemonics does not develop the memory, but sometimes helps in semantic memorisation. But associative memory may also let a person down, as was described, for example, by the Russian classic Chekhov in his story *A Horse Name*. The readers who are familiar with this story will recall that the name was supposed to be Oats.

HYPNOPEDICS

On the rostrum was a Sunday issue of the *Komsomolskaya Pravda*, some of its paragraphs marked with a red pencil.

"Popular foreign magazines have recently coined a new term—hypnopedics. It is the designation of a method which makes it possible in some measure to utilise actively that third of one's life which one spends in sleep. This method was first employed in 1922 by a teacher of radio communications at an American naval school in Pensacola. Naval officers were taught the telegraph code in sleep. The code was transmitted to them through earphones.

"Last year this experiment was successfully resumed in France at the Carpiqué Aviation Training Base. This time a tape-recorder was used. There is a case of a French actress who has mastered Italian in three weeks by means of hypnopedics. Special tape-recorders for teaching in sleep are already on sale in France."

Before beginning my next regular lecture to Moscow University students of psychology I had to clear up this question which had also been studied in the Soviet Union.

Hypnopedics (teaching in sleep) is theoretically possible. But so far it is another sensation of the bourgeois press and advertisement of the tape-recorder company. The practical employment of this method presents many difficulties.

Although one may agree that the "use of hypnopedics produces no fatigue", it is physiologically incontestable that it cannot help tiring the working cells of the cerebral cortex. Not to feel fatigue does not mean not to be tired. This aspect of the question should be very well studied before hypnopedics finds practical application. The biological importance of sleep, as rest, is too great to be easily relinquished. Moreover, the reaction to such "whispering" will be strictly individual. In expectation of it some people will merely fail to fall asleep, while others will sleep so fast that they will not hear anything.

But there is one more—psychological—objection to hypnopedics which may lead only to mechanical memorisation and be a mere makeshift for cramming. Semantic memorisation which ensures the readiness of memory and inclusion of the memorised material in the system of acquired knowledge is active memorisation. That is why the well-known attempts to use hypnopedics are connected with memorising codes, foreign words and similar material memorised essentially mechanically.

This does not mean that the question deserves no special study in the process of which new discoveries will probably be made. Victor Hugo said, "To disregard a phenomenon, to turn away from it with a laugh means to foster the bankruptcy of truth."

HOW TO IMPROVE THE MEMORY

Everybody would like to improve his memory, but not everybody knows how to do it.

The first and foremost rule here is: to develop your memory, you must develop your memory. And this is not tautology, for there are many people who want to improve their memory first and use it afterwards. That won't do. Only by continuously training, loading and utilising the memory, by continuously memorising, reproducing what has been memorised and memorising again is it possible to improve the memory.

In addition, there are several, I would say, particular rules useful only when the main rule is observed.

Repetition is one of the most essential conditions for firm memorisation. This idea has found its reflection in the old adage: "*Repetitio est mater studiorum*" (Repetition is the mother of learning). But, as special experiments have shown, not all repetition, by a long shot, leads to positive results; to do so, it must be comprehended and purposeful. The repeated material must be examined each time, as it were, from a new point of view, and the already known facts must be tied in with new facts, or the material quickly makes one sick and tired, and one loses all interest in it. Mechanical repetition, as has already been said, is unproductive cramming.

The following must be remembered when learning anything. For some people the evening is the most productive time, for others—the morning. The least effect is produced by learning during the day, among other things. It is most expedient to memorise in the evening and repeat the following morning.

The material must at first be studied as slowly as possible to facilitate its comprehension and make it possible to establish the necessary connections; then it may be learned more rapidly. If unconnected and rather extensive material has to be memorised, it is best to divide it into small parts unified by some common characteristic. For example, to learn 40 names quickly, divide them into four or five groups as homogeneous as possible; if the worst comes to the worst, they can be grouped at least according to a common first letter.

Things unified by one thought into a thematic whole are the easiest to memorise. That is why it is not advisable to cram each individual line when learning verses or the words of a song.

Lastly, the possibilities to strengthen the memory include a proper regimen and an ability to keep notes systematically. A notebook is a cultured person's second brain.

It should be remembered that everything that contributes to a person's health also makes his memory more productive.

Chapter 8

EMOTIONS

TO EACH ACCORDING TO HIS NEEDS

The 22nd Congress of the Communist Party of the Soviet Union adopted a new Programme of the Party. It is a programme of building a communist society with the following inscription on its banner:

*From each according to his ability,
to each according to his needs.*

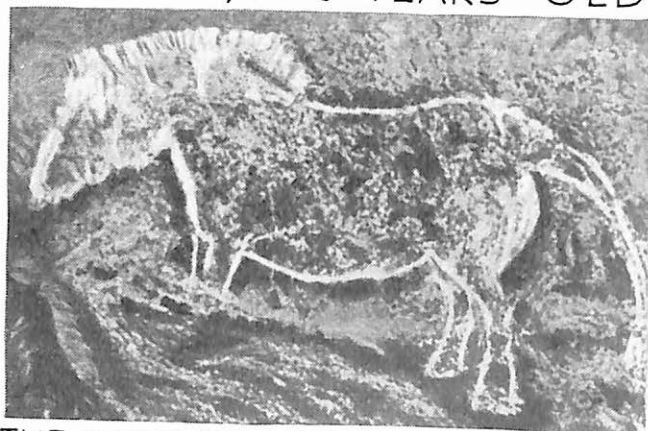
It goes without saying that the needs of the people of communist society will not be the same as those of the people of preceding social formations.

The human necessity to have adequate living conditions manifests itself as a requirement to create such conditions and is experienced as a feeling of need. A person striving to satisfy a need may sometimes be scarcely aware of it, in which case we call it a drive; if he is cognizant of it and his striving is purposeful, we call it a desire.

Man's elementary biological requirements are determined by the activity of his organism. His more complex-material-needs are determined by two basic instincts—self-preservation and perpetuation of the human race. Man must satisfy his hunger, have clothes and a dwelling; he must have children and must bring them up. However, these needs vary with the different people and different times. "Hunger is hunger, but hunger which is satisfied with cooked meat eaten with a fork and knife is different from the hunger satisfied by devouring raw meat rent with the hands, nails and teeth," said Karl Marx.

The ownership of the means of production engendered the need for ownership in general; the need for owning more and more property in its turn gave rise to parsimony, accumulation, opposition of the personal to the social, greed and envy, in a word, all those traits which are unified by the concept "private-ownership psychology".

THIS PICTURE IS MORE
THAN 20,000 YEARS OLD



THE NEED TO RETAIN THE IMAGE
WHICH HAD EXCITED WONDER
MADE PRIMITIVE MAN
DECORATE THE WALLS OF HIS CAVE

But even at the very dawn of human culture man felt other and higher needs—the spiritual needs for cognition, creativeness and beauty. Already primitive man had the need for speech, intercourse with other people, which developed into mutual aid, a need for explaining and then depicting the surrounding world, a need for adorning himself and his household articles, and a need for music.

In class society the spiritual needs of the exploited were suppressed by their struggle for existence, and those of the exploiters often assumed perverted forms.

When the first tramcars were launched in Moscow, some merchant would now and then buy up all the seats in a tramcar to ride alone, since his means enabled him to satisfy his whim. The age-old "private-ownership psychology" still has a strong hold on the consciousness of some people and manifests itself in the dictum: "it may be bad, but it's my own".

Communism will completely satisfy the basic material needs and will lead to the total disappearance of the perverted needs, which are survivals in the minds of people, and will foster rapid development of the spiritual needs—cognitive, ethical and aesthetic. But the principal need of man in communist society is the need for work.

"Labour for the benefit of society is the sacred duty of all.

"It is impossible for a man in communist society not to work, for neither his social consciousness, nor public opinion would permit it. Work according to one's ability will become a habit, a prime necessity of life, for every member of society."

This is recorded in the Programme of the Communist Party of the Soviet Union. And this is as it will be!

DIFFERENT MOODS

"And you will always be in a good mood..."

Thus sang a young girl, and it was apparent that the song quite expressed her own mood.

"Why are you sulky so early in the morning, Masha? Did you get out of bed on the wrong side?" she kept pestering another girl who was really out of sorts.

"Leave me alone; I am tired of your songs," the other girl snapped back. "Anybody can be in low spirits without any reason."

She was wrong. Nothing ever happens without any reason. This was already clear to the ancient Greek philosopher Leucippus (500-440 B.C.). Nor can anyone be in low spirits without any reason.

A healthy person who has had a good night's sleep and who is not beset with misfortune or troubles should be in a good mood in the morning. By nature man is an optimist.

Formerly, when a person woke up in low spirits and got out of bed "on the wrong side", he took the effect for the cause; that gave rise to the superstition: if you get out of bed on the wrong side, everything will go wrong that day.

Mood is the weakest and at the same time the longest manifestation of emotions. A certain mood may persist without changing for a very long time, sometimes for weeks, and in a sick person even longer. But usually moods vary with the changes in the surroundings which affect a person.

While we were talking, the weather changed, the sun came out; Masha began to smile and hum in tune with her friend. Her mood changed.

What is emotion?

Emotions or feelings are a special form of man's relations to objects and phenomena of reality conditioned by their correspondence or non-correspondence to his needs. In addition to perception and thinking, emotions are one of the forms of the world's reflection in the consciousness. But they have their own specificity. Reflecting the real relations of the world, man experiences them as his own subjective relations to it.

The clouds hid the sun from Masha. The not-very-angelic voice of her friend jarred upon her ears, and she was displeased with the clouds and

her friend. The sun came out of the clouds and made it light and warm for Masha and Masha experienced a feeling of joy and gratitude to the sun.

Emotions play a very important role in man's life, lending it a certain sensuous colouring. "Without human emotions there has never been, nor can there be a human quest for truth", wrote V. I. Lenin with his characteristic emotionality.

AFFECT

*The mother first beheld with sad survey;
She rent her tresses, venerable grey,
And cast, far off, the regal veils away.
With piercing shrieks his bitter fate she moans,
While the sad father answers groans with groans. . . .
And the whole city wears one face of woe.*

If Homer is to be believed, that was how Priam and Hecuba mourned over their slain son Hector in the *Iliad*.

The following emotional reaction took place during the meeting of Telemachus and his returned father Odysseus, as described by Homer in the *Odyssey*:

*. . . and tears in tides had run,
Their grief unfinish'd with the setting sun;
But checking the full torrent in its flow,
The prince thus interrupts the solemn woe. . . .*

In both cases the described feelings reached the state of affect. If a mood may be compared with a warm or cold breeze, an affect is a hurricane raging in the mind and always leaving ruin and havoc. In a state of affect a person does things he would never do in a calm state. In a state of severest, so-called "pathologic affect" a person is not responsible for his actions.

This does not mean, however, that a person in this state is not answerable for what he does. The state of affect does not set in suddenly, and a person can pull himself together rather than yield to it. That is why a person must bear responsibility for all he does in the state of affect.

In antiquity and during the Middle Ages people easily fell into a state of affect precisely because they considered it unnecessary to control its manifestations. At funerals, for example, special weepers feigned manifestations of grief.

GAMBLING

"Gambling prohibited", this sign may be read in holiday-homes and other public places and implies playing cards for money. Card games originated in hoary antiquity in the East and were brought to Europe by

seamen approximately in the 14th century. In France and Germany playing cards were about the same in the 15th century as they are today.

The earliest mention of card games in Russia dates from 1649. This mention pertains to the strictest prohibition to play cards and includes an order ruthlessly to eradicate card games precisely because of the gambling spirit.

Gambling is emotional excitement connected with a desire to win at all costs and an urge to continue playing. It appears when the desire to win or win back becomes stronger than the voice of reason, suppresses reason and renders thinking uncritical. The greater the interest in a game, the easier the development of the gambling spirit. Such games are commonly called "playing for stakes".

But a player may develop the gambling spirit not only in card games. Even while playing the game of "clapping hands" children sometimes hurt their hands to the point of tears, but continue playing because of the gambling spirit. Not only players, but also spectators may develop the gambling spirit.

Gambling is a manifestation of a weak will in a game, of unwillingness or inability to control one's own emotions; it is a negative feeling and a negative quality of the personality. The good things that are sometimes ascribed to gambling pertain not to gambling as such, but to the zeal attached to it, for example, the zeal for one's work.

FORBIDDEN FRUIT IS SWEET

The people waiting for the ship were whiling away their forced and wearisome wait by reading the "Rules for Passengers" which hung in a frame on a wall of the waiting-room.

"I never thought anybody could enjoy standing on the landing in his underwear. Now that I know it is prohibited I should like to try it myself," one of the waiters wisecracked.

But maybe he did not mean it as a wisecrack? Maybe he really wanted to try it? Didn't Pushkin write in *Yevgeny Onegin*:

*O mortals, everywhere ye seem
Like Eve, progenitress so distant!
Untempted—when you're free to take—
To that mysterious Tree the Snake
Still summons you, with voice insistent.
That fruit forbidden—hand it o'er,
Or Eden—Eden is no more.*

Many popular legends and fairy tales revolve about the idea that that which is forbidden is sweet. In ancient Greek mythology there is a myth

about a girl named Pandora whom Zeus gave a box containing all human ills. Like most girls, Pandora was very curious and wanted to look into the box especially since she had been forbidden to do it. She opened the box and all the human ills escaped into the world. Bluebeard's wives died because of their irresistible desire to violate a prohibition.

Not only in fairy tales, but also in real life it is often enough to say "No" to a person to make him want to do that which is forbidden. I am sure many of my readers will have read these lines right after the introduction precisely because I asked them not to and especially since my request "But, please, do not read the story on p. 202 just yet" is italicised.

Forbidden fruit is sweet for different reasons in different cases. The positive aspect of it for each individual person, as well as for all of mankind, is a striving for knowledge, a desire to learn the unknown which may have attracted no attention if it were not forbidden, since prohibition will not only necessarily attract attention, but will also focus it on the "forbidden fruit".

Moreover, the very fact of prohibition, if it is not explained, aroused all sorts of suppositions, conjectures and a legitimate desire to know why something must not be done.

Parents often limit themselves to prohibiting without motivating their "don't's". The feeling that the prohibition is ungrounded gives rise to doubts and a striving to violate it. Who will ever want to eat apples from a tree on which there is a sign: "Do not eat these apples, they are sprayed with poison"? But the thought "Dad smokes, but tells me not to" engenders attempts to taste the forbidden fruit. An important part is played by imitation or envy.

"You're too young to smoke!" is the argument which usually increases envy and drives youngsters to secret smoking.

The history of potatoes brought to France from America is instructive. In France they were long prevented from making headway because the clergy called them "devil's apples", physicians considered them unhealthy, and agronomists asserted that they exhausted the soil.

The famous French agronomist Antoine Parmentier who, while a prisoner of war in Germany, had eaten potatoes himself, wanted to introduce them in France upon his return, but long failed to persuade anybody. He decided on a ruse. In 1787 he received the king's permission to plant potatoes on land notorious for its infertility. At his request the field was guarded by an armed detachment of the king's soldiers in full dress, but only in the daytime. For the night the guards were withdrawn. And then, attracted by the forbidden fruit, the people began to dig the potatoes out at night and plant them in their own kitchen gardens.

That was precisely what Parmentier was after.

HAPPINESS

"Wish you lots of happiness", is the way we often finish our letters, and this is the most all-inclusive wish. But what is happiness?

Some say it is pleasure. To a certain extent they are right. A drink of water for a person dying of thirst is more than a pleasure. It is happiness. And so is a morsel of food to a starving person. And a warm room for a wayfarer in a snowstorm is also happiness.

A few years ago the British physiologist James Olbe implanted an electrode in a certain part of the rat's subcortex. By pressing on a special pedal the rat could send an impulse of current through this electrode to its own brain. This part of the brain was the "pleasure centre", and its stimulation pleased the rat. The rat literally danced with joy and kept pressing on the pedal; it pressed on the pedal up to 8,000 times an hour forgetting about food and bringing itself to the point of exhaustion.

Next to this centre there were centres of displeasure, and, if the electrode was implanted there, the rat was no fool and never pressed on the pedal more than once.

Now such happy rats dancing with joy may be seen in P. K. Anokhin's laboratory. What I am saying is not fiction. These rats are happy with their rat happiness which in no way differs from the emotion of pleasure produced by the impulse of current. They are incapable of more. But then they are only rats.

On the other hand, is our happiness—yours and mine—mere pleasure? Of course, not. We are not rats. The happiness of man is a feeling of satisfaction with his activity which is of benefit to others; it is a feeling of creativeness engendered in constructive work.

Psychologically the feeling of happiness is always experienced when the result of an activity coincides with the aim a person has set himself. The more important the aim and the more difficult it is to achieve, the happier the person who achieves it.

ALIKE, BUT NOT THE SAME

The expressions of feelings and experiences by man and animals are in many respects alike. This was pointed out by Charles Darwin from whose books I took the pictures printed here. The biochemical changes, for example, the increase in blood of sugar caused by strong emotions are also very much alike. "Who would separate in the most complex unconditioned reflexes (instincts) the physiologic, somatic from the psychic, i.e., from the

WITH THESE PICTURES DARWIN EXPLAINED THE COMMON EXPRESSION OF FEAR



IN MAN AND IN THE ANIMAL

experience of the powerful emotions of hunger, sexual drive, rage, etc.?" asked Pavlov.

But a common origin is as yet not identity, and the psychic content of the experience of fear by the cat and man cannot be identified.

By looking at the picture (p. 205) also taken from Darwin's works you can make sure that the "sweetly pouting lips" of a pretty girl show that she is very much like the chimpanzee.

But I want to reassure her admirers once more: likeness is not identity.

COUNTENANCE

Lev Tolstoi described 85 shades of expression of the eyes and 97 varieties of smile which disclose the emotional state of man. "The eyebrows and mouth change differently with the different reasons for crying," said Leonardo da Vinci.

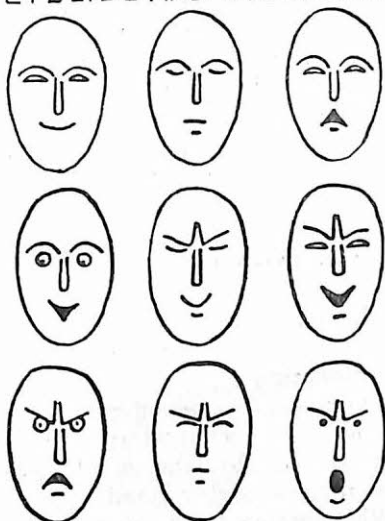
The drawing made by the Soviet psychologist P. M. Yakobson shows that the expression of the human face essentially depends on the combination of the positions of the lips, eyebrows and eyes. It partly depends on the

THE MONKEY THUS EXPRESSES ITS DISCONTENT



sparkle of the eyes determined by the amount of tears, filling of the blood vessels in the mucous membrane and the size of the pupils. Eyes seen through a mask lose their expressiveness.

VARIOUSLY COMBINED POSITIONS OF THE EYES, LIPS, EYELIDS AND EYEBROWS



DETERMINE THE VARIOUS EXPRESSIONS OF EVEN SUCH A FACE

HOW I HAMPERED W. MESSING

The involuntary manifestation of emotions in gestures is utilised by Wolf Messing in his performances of "reading thoughts" which we have already discussed. I had an occasion to demonstrate this.

According to the terms of the performances, the assignment which somebody writes down on paper is read by all members of the jury sitting on the stage. Observing that during his performance Messing often looks at the jury and asks them to "think better about the assignment" I took an assignment from a friend of mine and made sure to get on the jury where I colluded with a few members of the jury and, although not one of us had read the assignment, we said to the rest of the jury that we had read it and that it was very interesting. Messing took my friend by the hand and began his performance. This time Messing was repeatedly making mistakes and kept looking at the jury, asking them to "think

better of what had to be done". But the jury could not think about anything, the jurors having no idea about the assignment and looking at each other absent-mindedly. Then Messing's assistant intervened and, learning that not all members of the jury knew the assignment, demanded that I should let them all read it in her presence. After this Messing did much better. He saw, as also did I, that when he was going in the wrong direction an impressionable woman on the jury involuntarily shook her head, and when he did something right she simply beamed with delight.

Allegedly in order that there may be no deceit, the 10-12 members of the jury are selected from the public; but there are always a few particularly impressionable people among them.

FEELING AND POSE

About a bad actor we usually say: a mere pose and no feeling. Such an actor cannot co-ordinate his pose with the expression of his face and his intonations.

Talented actors shed real tears on the stage and deeply experience the feeling of the characters they personate. There was a case of an actor playing Othello who would have strangled Desdemona if the curtain were not lowered in good time.

While acting in the play *Velvet and Rags*, the famous Russian actor A. A. Ostuzhev was once carried away by his role to such an extent that in the fighting scene he broke Kuznetsov's (his partner's) arm. In her memoirs N. A. Lunacharskaya-Rozenel says the following about the incident:

"Kuznetsov was outraged.

"'It's dangerous to play with him. He is a rabid beast. Just think of it—to cripple his partner! I'm not going to act in that play any more. One of these days he'll kill me.'

"Ostuzhev kept repeating in his beautiful and moving voice:

"'Excuse me, my dear friend. I'm dreadfully sorry. But what can I do? I'm very fond of you, as Kuznetsov, but I hate Wabbe' (the character he personated)."

Shakespeare was aware of the dependence of feelings on facial expressions and gestures. The following is a monologue from his *Henry V*:

*But when the blast of war blows in our ears,
Then imitate the action of the tiger;
Stiffen the sinews, summon up the blood;
Disguise fair nature with hard-favour'd rage;
Then lend the eye a terrible aspect. . .*

THE POSITION OF THE ARMS
IMPARTED TO A PERSON IN A STATE OF HYPNOSIS
CHANGES THE POSE AND COUNTENANCE



*Now set the teeth, and stretch the nostril wide;
Hold hard the breath, and bend up every spirit
To his full height!—On, on, you noble English. . .*

The connections between an experience and its manifestations are so great that James and Lange (American and Danish psychologists) suggested at the end of last century a theory which is essentially a paradox: we laugh not because something is funny, but it seems funny to us because we laugh.

They said: double your fists, clench your teeth, knit your brow make every possible gesture to express rage and you will begin to experience this feeling; start laughing and something will seem funny; start walking in the morning, hardly dragging your legs along, your arms hanging, your back bent, and a melancholy expression on your face, and after a while you will really be in low spirits.

Although the theory of James and Lange is wrong as a whole, since the source of emotions is the external world and not poses and gestures, the conditioned reflex connections between poses and feelings are incontestable. I happened to take part in experiments which convincingly proved it.

The arms of an actress in a deep hypnotic trance were put in some expressive position, and the entire pose and countenance assumed, as shown in the pictures, a corresponding expression as the result. After awakening the actress related that she had dreams in which she had experienced the corresponding feelings.

VERDICT OF THE GODS

Various peoples used various methods to reveal persons with a guilty conscience. The story of how a thief grasped at his hat when a wise judge called "the thief's hat is on fire" is found in different variations in the epics of many nations.

In the past one of the Indian tribes had the following custom: The judge addressed to the suspect words some of which had something to do with the case at hand: "stole money" or "the purse", the name of the victim, the amount of money, etc. The defendant had to answer quickly using the first word that crossed his mind and simultaneously very weakly strike a gong, so weakly that only the judge should hear it, and the people standing farther away should not. If the person was really guilty he would, while answering the judge to a disturbing word, involuntarily strike the gong harder and the people heard the gong accuse the thief.

At one time the Chinese also had a similar custom. During the trial the defendant held a handful of dry rice in his mouth. If after hearing the charge, he spit out dry rice he was considered guilty. This custom is also

based on psychology. Fear experienced by man causes a number of bodily changes, one of them being diminished salivation, the mouth becoming dry. If the thief fears exposure, his mouth becomes dry and the rice in his mouth remains dry.

Such "verdicts of the gods" could work only in regard to defendants who deeply believed that the verdicts were just. A person who is afraid of being unjustly condemned as the result of miscarriage of justice will also have a dry mouth and dry rice in it.

The so-called "lie detectors" used in the legal proceedings of some countries lead into error for the same reason. These instruments accurately register the changes in the pulse and respiration under the influence of emotions, but they cannot reveal whether these emotions are caused by recollections of the crime, a fear of being unjustly convicted, or anything else.

THOSE WHO LOVE MUSIC

A friend of mine held that opera was the most expensive noise imaginable. Of course, very few people will agree with this. However, not everybody likes opera or music in general; those who like music like different music and like it in different ways.

The emotional reaction to music has two aspects: unconditioned and conditioned reflex aspects. The former is determined by the laws of acoustics and the physiology of the auditory apparatus. Some combinations of sounds are perceived as inharmonious and the sensations they produce are unpleasant, i.e., sensations of dissonance. Other sound combinations are harmonious. Play or ask someone to play loudly on the piano the two combinations of sounds given in the picture, and you will find one of them unpleasant and the other pleasant to the ear.



The conditioned-reflex influence of music is determined by musical education. Every person has favourite melodies associated with definite pleasant memories. If we know the conditions under which a musical composition was written and how it was conceived by the composer, we appreciate it more and listen to it with greater interest. In other words, we learn to appreciate music in the process of our musical education. "Only music awakens man's musical feelings," said Marx.

My friend who referred to opera with such disrespect was merely musically uneducated.

But no small part in a person's positive reaction to music may be played by imitation which is a substitute for a musical education. "All my friends whose opinion I esteem like this new record. Oh, it's simply wonderful!" Those whose own taste is replaced by fashion not only say, but also feel that.

ABSTRACT PAINTING

"Why is this a cathedral?" asked a visitor at the American Exhibition in Moscow examining a picture of Jackson Pollack, pillar of abstract painting. "It's merely colourful wallpaper or chintz."

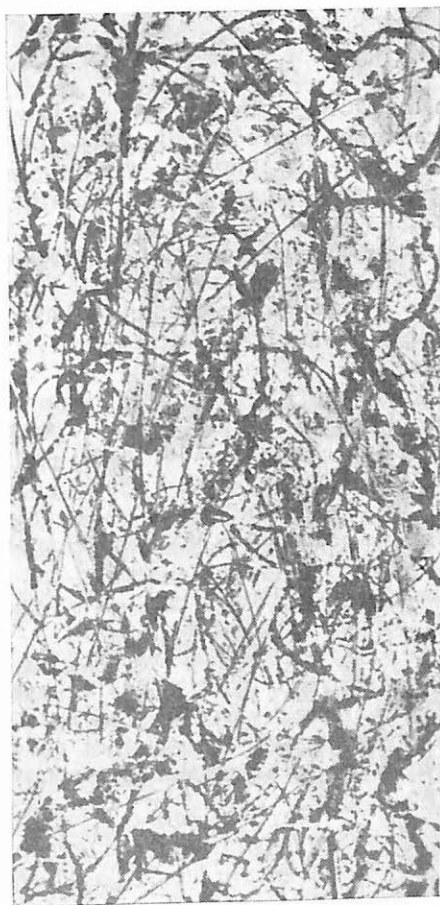
The visitor noted one of the psychologic aspects of abstract painting, which in the prospectus published for the exhibition was characterised as follows: "The physical elements of forms, colours, lines and material become independent individual means of expression, appealing directly to the feelings and through the feelings to the mind, like sounds and music."

But this problem is being solved by mankind since time out of mind in so-called ornamental art which, incidentally, includes wallpaper and chintz patterns. It is sometimes said that in music melody corresponds to pattern, and harmony—to colours. A good ornament sometimes exerts its action on us through the eyes, as music does through the ears. It is no mere accident that quests for a new form of art are now under way; the foundation for this art-colour music—was laid down by A. N. Scriabin (1872-1915).

An ornament activates our fantasy and by association may call up images not directly represented in it. When you choose spring wallpaper of a cheerful colouration instead of the dreary wallpaper which the builders like, you won't assert that the pattern on them represents spring, will you? They may remind other people of their childhood. It wouldn't be a bad idea, though, to give names to wallpaper, as it is done to perfume, powders and creams.

The quest for sensation which always kills true art is the second psychologic aspect of abstractionism. It is precisely sensation that impels

WHY THIS IS A CATHEDRAL
AND NOT WALLPAPER



ONLY JACKSON POLLACK,
ABSTRACTIONIST PAINTER AND AUTHOR OF THIS PICTURE, KNOWS

the "artist" to frame a piece of ornament which at times pleases the eye and to give it a pretentious name that puzzles the spectator. It is precisely in this fashion that makes unintelligent people admire pictures painted by a monkey (colours smeared on canvas) or a donkey (smearing colours on canvas with the tail). The most important thing is that this principle prompts reactionary painters to become like the aforesaid beasts which do not understand what they paint.

"POET"

In the story under the above title written in 1928 Karel Čapek ridicules abstractionist poets by telling how police commissioner Meislik discovered in a somewhat unusual manner the licence number of the escaped automobile which early in the morning had knocked down a drunken old woman.

Čapek thus describes the interrogation of poet Nerad who, while far from sober, was an eye-witness of the accident.

"Try to recall some trifle, some detail," Meislik insisted.

"Why," Nerad exclaimed in startled surprise, "I never notice details."

"Won't you, please, tell us what you did notice, if anything," Meislik inquired ironically.

"Merely a general mood," the poet answered indefinitely. "A deserted street, if you know what I mean ... long ... before dawn. And a female figure on the ground. ... Wait a minute!" the poet suddenly jumped up, "I wrote a poem about it when I came home."

He began to dig in his pockets, extracting bills, envelopes and crumpled scraps of papers from them.

"This isn't it, and that isn't it. ... That's it, I think." And he plunged into reading some lines written on an envelope turned inside out.

"Show it to me," Meislik said ingratiatingly.

"These are really not my best verses," the poet observed modestly, "but I shall recite them, if you want me to," and showing the whites of his eyes he started reciting in a sing-song voice.

*A row of houses loomed upon the shore.
The sun went down, inspiring in the azure
A virgin blush. To far-off Singapore
You sped upon your sports-car, blind to danger.
Now falls the tulip, broken, in the dust.
Silent lies passion, dead lie love and lust.
O swan's neck! O bewitching, lovely bust!
And o, that drum, those drumsticks,
Meaning: what will happen—must.*

"That's all," said the poet.

"I beg your pardon, but what does all that mean?" asked Meislik. "What is it all about?"

"What do you mean?" the poet sounded surprised. "About the automobile accident, of course. Isn't it clear to you?"

This is followed by a dialogue in which the poet delves into associations which only he alone understands (for example, he associates Singapore

and Malayans with the brown colour of the automobile, the last lines of his poem with the licence number of the car, etc.—*Author*).

"All right, then," said Meislik writing down No. 235 on a sheet of paper. "Are you sure the licence number was 235?"

"Number? I never noticed any number," the poet objected resolutely. "But there must have been something like that or I would not have written it that way. I think those are the most felicitous lines. Don't you?" (The automobile actually turned out to be brown and its licence number—235.—*Author*.)

DIALOGUE ABOUT BEAUTY

"I am a man of science," the laboratory technician said to me, "and let men of art deal with beauty, of which I haven't the faintest idea."

"That you understand little about art is not to your credit," I rejoined. "Chernyshevsky* pointed out long ago that it is wrong to oppose art to science. He held that development of thinking did not destroy the aesthetic sense in man. The sense of the beautiful came into being in human history as a product of social development, and in each person this manifests itself in the process of personal aesthetic education, which is inseparable from the general development."

"But tastes differ," my opponent persisted.

"I think you also have a wrong idea of this saying. The same Chernyshevsky convincingly demonstrated that the criteria of beauty really differ with the different classes, but are uniform enough within the same class. According to their criteria, all peasants consider beautiful a fresh complexion, high colour covering the whole cheek, and sturdy build, i.e., the result of continuous physical work under good natural conditions. Their taste differs from that of the people who have developed the ideal of the woman of fashion with small, delicate hands, unhealthy pallor, weakness and languor which are the result of a rich, but physically inactive life. The privileged class of ancient China regarded as beautiful crippled female feet, and hands with nails many centimetres long; these were considered signs that their possessors did not have to walk or, especially, work."

"But what is the beautiful? How can one learn to see it?" my interlocutor began to give in.

"Then listen to me," I said. "The beautiful is life. That being is beautiful in which we see life as we think it should be. That thing is beautiful which manifests life or reminds us about life. These are Chernyshevsky's words. Gorky spoke about another aspect of beauty. By beauty, he held,

* Nikolai Gavrilovich Chernyshevsky (1825-1889), Russian revolutionary democrat, scientist, writer and literary critic. He formulated the principal theses of materialist aesthetics as "the beautiful is life".—*Ed*.

we imply such a combination of various materials, as well as sounds, colours and words, which imparts to the thing created, made by the human master, a form that affects the feelings and intelligence as a force exciting in man surprise at, pride of, and joy at man's creative ability. Try to understand these words. You must learn to perceive the beautiful, in other words, to educate in yourself the aesthetic sense, the sense of enjoying beauty by perceiving the beautiful and evaluating it by comparing it with the criteria of the beautiful borrowed from man's experience."

I failed to teach my laboratory technician to love the beautiful. He was taught by a girl with whom I often met him at exhibitions and concerts afterwards.

EDUCATION OF THE FEELINGS

Bartok, Prokofiev, Shostakovich, Britten, Khrennikov, Kabalevsky, Gerster, Hindemith, Glière—it was their music I heard in Gorky yesterday.

I came out into the street together with a group of students. We had sat side by side in the concert-hall and made each other's acquaintance. They were students of an agricultural and pedagogical institutes and, although it was examination time, they went to this concert just the same. As a matter of fact, they had bought the tickets for it a whole month in advance (!).

"Did you understand everything?"

"Did you?"

"No, I did not understand everything, but I felt everything. This never happened to me before. I was even taken aback, so much suddenly opened itself to me in music. I have so many ideas now, I'm overwhelmed with them."

"What a musician this Rostropovich is! He is all music. His 'cello makes you feel you are listening to 20 voices."

"That's right, fellows, all of it is great stuff. I have a feeling we have bathed in music."

It was wonderful to hear those words. It means the people needed this festival. This item was signed: Special correspondent of the *Izvestia*.

I copied it from a newspaper word for word without changing a thing. I don't think any comments are necessary.

THE APPASSIONATA

Gorky recounted that one day, while listening to Beethoven's Sonata, Lenin said:

"I don't know anything that is better than the *Appassionata*. I could listen to it every day. It's amazing, superhuman music. I always think with pride, perhaps naïve: here is what wonders man can do."

And, screwing up his eyes, he smiled and added sadly:

"But I can't listen to music often; it gets on my nerves; it makes me want to say sweet little nothings and stroke the heads of the people who, while living in filthy hell, can produce such beauty. But today I must not stroke anybody's head, because they'll bite off my hand."

Incidentally, Dear Reader, do you know what the musical term *appassionato* means? It is an Italian word meaning *with passion, with strong feeling*.

JOY OF VICTORY

Two stags have locked antlers and are fighting for the doe standing nearby. The winner goes off with her to create a family. Ascribing his own feelings to animals the man of the distant past also ascribed the joy of victory to them.

As a matter of fact, the stag that subdued his rival experiences no emotion save calming down after the rage that dominated him during the battle. The bee experiences no joy at a well-made cell. Man began to oppose himself to nature and strove to master it even at the time when he was but one step ahead of apes in his development. Everything or nearly everything he could do in this respect was connected with satisfaction of some need and gave him a feeling of contentment and joy; he was satisfied when he killed an animal, glad when he built a hut, happy when he struck fire.

The feeling of joy of victory over the forces opposing man thus came into being and grew more complex. It infused courage, instilled confidence, inspired in the struggle against difficulties and mitigated the temporary troubles. "The wounds of victors heal quicker than the wounds of the vanquished," was justly said by Larrey, Napoleon's surgeon.

The ideology of class society favoured formation of the feeling of triumph of man over man in wars, jousts and all other forms of competition. However, man experienced the feeling of joy much more often from victory over nature and not over other men. Much stronger and more human emotions were manifested in Archimedes' exclamation *Eureka!* than in the shouts *Habet!* with which the Romans gave expression to their feelings at the sight of a fallen gladiator.

The individualism of the class society forced man to oppose himself not only to nature, but also to other men. That is why the keenest joy of the man of pre-socialist society was that of personal victory.

This feeling is very typical of the characters of Jack London and of himself. It is well-expressed in his autobiographical book *The Cruise of the Snark*. "The thing I like most of all is personal achievement—not achieve-

ment for the world's applause, but achievement for my own delight. It is the old 'I did it!' I! I did it! With my own hands! I did it!"

The same feeling also made Pushkin joyously exclaim after a successful piece of work: "Ataboy, Pushkin!"

The joy of victory is unthinkable without a feeling of enthusiasm for one's work. These feelings are very similar in origin and in content of the experience.

This is not a bad feeling. Man will probably retain it in communism. But already the man of socialist society, when experiencing the joy of victory, increasingly more often substitutes the word WE for the word I.

FUNNY

Sometimes a person recounts some story and literally chokes with laughter, while to others the story does not at all appear funny. Different world outlooks, different interests and different cultural levels also determine the differences in the sense of humour. A cultured person does not find anything funny in a cat which with a tin can tied to its tail rushes about, mad with fear; but some people think it funny. The English even say that one should not marry a girl who does not laugh at the same things.

Laughter—the manifestation of the sense of humour—has many shades; there are also many reasons for laughter.

Aristotle reasoned that the ludicrous is some error or some abnormality which inflicts no suffering or harm. It is something ugly and deformed, but without suffering.

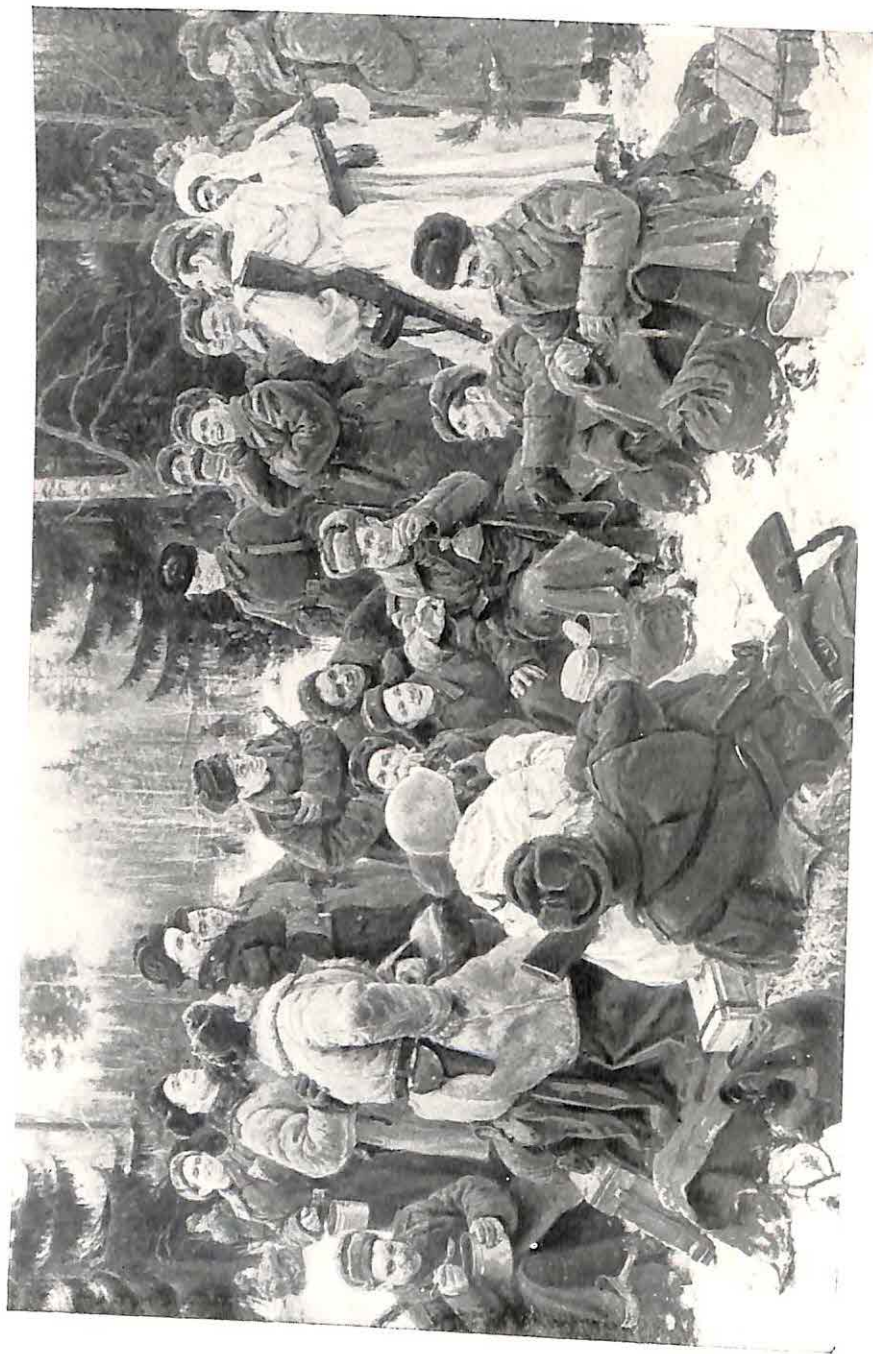
In humour a joke conceals a serious treatment of a subject, while irony conceals a joke behind a serious form. Both are of an accusatory, condemnatory, but not malicious character typical of mockery, and are devoid of the feeling of bitterness typical of sarcasm.

A risible mood sometimes persists for a long period, and laughter often breaks out for trifling reasons. But it may attain to the magnitude of an affect in Homeric laughter named after the creator of the *Odyssey* and the *Iliad* and implying something enormous and unusually strong, like Homer's characters.

A remarkable representation of various shades of laughter is given by the noted Russian painter Ilya Yefimovich Repin (1844-1930) in his painting *Zaporozhye Cossacks Writing Their Reply to the Turkish Sultan*. I cannot quote here the text of the letter because of the, so to speak, specificity of expressions, but you may rest assured that they did it in vivid terms as the painting suggests. I am sure Repin had read the letter, but neither he nor I laughed as did the Cossacks.



"ZAPOROZHYE COSSACKS" (REPRODUCTION OF A PAINTING BY I. REPIN)



"AFTER THE BATTLE" (REPRODUCTION OF A PAINTING BY Y. NEPRINTSEV)

The strength of the sense of humour and the laughter as its manifestation depend on what is perceived, by whom and under what conditions. Look at the clerk, at the Cossack on the right and at all the other faces and figures, and you will see how differently they react to the letter. The Soviet painter Yury Neprintsev in his picture *After the Battle*, more widely known as *Vasily Tyorkin* has masterfully depicted the individual reactions to the humour of the story-teller, the different manifestations not only of laughter, but also of grinning.

TWO FORMS OF FEAR:



PASSIVE-DEFENCE

AND



ACTIVE-DEFENCE REFLEXES

Lastly, let us recall one more form of laughter—the famous humour of Gogol, which he himself characterised as “laughter visible to the world through invisible tears”.

FIRE

I remember reading a story about two young people in love. He was sincerely sure that he would readily give his life for her well-being.

Several days before their intended wedding they went to the opera. During the performance it began to smell of burning. Somebody called, “Fire!” This started a panic. The people rushed for the exit, crushing each other and unaware of what they were doing.

He thought of her only after he had climbed to the street over the heads of the other people. One could not possibly

make his way back against the crowd. He waited (you can imagine the feelings that possessed him). The crowd dispersed, and she came out into the street, passing him by without even looking at him. They never saw one another again.

The story made me wonder if she was right.

Now I know she was.

Panic is an effect of fear, but a person does not have to yield to it. He did, and thereby discredited himself in her eyes.

But panic also has another aspect. A person more often becomes panicky under the influence of other people, not when he is alone, but when he is in a crowd—in a crowd of people like himself, but not in a collective. We have already discussed the collective on p. 171. The collective always uplifts a person, and in the collective a person is always better than he is by himself. Even a notoriously bad person improves in the collective. Even a coward becomes fearless.

It is a different matter with a crowd of philistines where everybody thinks not of the common good, but only of himself. Such a crowd is a terrible thing. Bourgeois psychologists who deal in so-called social psychology, but do not distinguish between a crowd and a collective, have developed a false theory that a person becomes worse in any group, that he becomes brutalised and loses the best part of his personality.

Marxist social psychology which studies not man by himself but man as a member of a group, rejects these views. Of course, not every group of people is a collective. There are so-called "unformed groups". These are, for example, people accidentally travelling together by train. Some of them may become very friendly and for a long time. But an unformed group always strives to become a collective. This manifests the social essence of man.

HEART SANK TO THE BOOTS

Another state of consciousness, common to man and animals, is panic fear when, as it is said, the heart sinks to the boots. In animals this passive defence reflex, as Pavlov called it, is biologically expedient and is therefore consolidated through natural selection. In man it is like, for example, the appendix, an unpleasant vestige.

Let us do a little experiment with a group of boys who are on a boat landing without permission. Let us steal up to them and call out, "What are you little brats doing here?"

Now watch them take to their heels, for their hearts sank to their boots before they had a chance to realise that they had not done anything wrong. Our shout frightened and confused them. In a similar manner a very big cat runs up a tree, scared by a tiny puppy.

But not all the boys have run away. One of them sat down on the ground and started crying. As it is very aptly said, "his knees sagged under him" and before that he had for some time "frozen with fear". This is the asthenic form of the passive defence reflex.

Another boy responded with a different reaction to our shout: he frowned, clenched his fists and came to me to find out what's what, although he, too, was scared. This is an example of an active defence reflex which makes a kitten arch its back, bristle up and prepare to fight even a very big dog.

"ECSTASY IN COMBAT"

"Because of this terrible roar and rumble and the need for attention and activity Tushin experienced not the least unpleasant sense of fear, and the thought that he might be killed or seriously wounded never occurred to him. On the contrary, he felt increasingly more cheerful. It seemed to him that long ago, maybe even yesterday, was the moment when he saw the enemy and fired his first shot, and that the patch of field on which he stood was a long familiar and dear place. . . .

"He thought of himself as of a man of enormous stature and tremendous strength, throwing cannon balls at the French with both his hands. . . ."

Lev Tolstoi thus describes in *War and Peace* the peculiar reaction to danger he had observed. The reaction was known already to Pushkin who made his chairman of the feast during the plague say:

*War knows the dizziness of drink,
Like the abyss's gloomy brink,
The darkness of the storm-tossed ocean,
The fatal heaving of her breast,
Arabian sands in wind-swept motion,
The fetid breathing of the pest.
And all that breathes the threat of death
For hearts that beat with mortal breath
The secret holds of wordless pleasure:
The pledge, perhaps, of deathlessness!
Happy the mortal who this treasure
Amid life's violence makes his.*

Kant divided the emotions into sthenic (from the Greek word *sthenos*—strength) which enhance the vital activities of the organism, and asthenic which weaken them. Fear, as we saw it in the picture, may manifest itself in both the sthenic and asthenic forms. But the reaction to danger,

described by Pushkin and Tolstoi, is not sthenic fear, but a peculiar state of joy, ecstasy of danger, a sense of fighting spirit characteristic only of man.

**NOT DANGEROUS,
BUT FRIGHTFUL JUST THE SAME**

Put a mattress on the floor, place a pillow, or even two, on it; now kneel on the mattress, holding your arms behind your back, throw your head back and try to fall on the pillow face forward without reaching out with your hands.

Some people will be entirely unable to do this because of fear. Others may be barely and almost imperceptibly scared. To strengthen the emotion of fear, the exercise must be made a little more complicated for them—they must be asked to do it from a standing position without bending their knees.

The physiologic mechanism of the experienced sense of fear is a passive defence reflex. Psychologically it is instinctive fear.

You know that, if you walk on a log or jump off a cliff you may get hurt, and your fear is therefore determined by quite logical apprehension of some, even if trifling, danger. But you know that by falling on a soft mattress or on a pillow, or even on several pillows, you cannot get hurt. And yet you are scared, scared despite logic.

These experiments show that there are two types of fear. Sometimes fear is the result of thinking, realisation of danger; at other times it arises independently of, and even despite thinking.

It is well known, for example, that experienced parachutists have stronger emotions when jumping from a parachute tower than from a plane. This is due to the fact that the proximity of the ground which must be looked at makes perception of altitude more concrete. That is why a person is afraid to jump, although reason tells him that it is absolutely safe.

If we could look through the skullcap (let us recall Pavlov's words quoted on p. 64) and if we could, additionally, record on a slow motion picture the processes operating in the brain, we would observe, in the former case, a luminous focus of excitation first appearing in the second signalling system of the cerebral cortex and then spreading to the subcortex. In the latter case it arises in the subcortex and we would see a dark spot of inhibition spreading through the cerebral cortex, according to the law of negative induction. These two types of emotion may appear not only in fear.

TENSION—BANE OF LEARNING

Jacky could not swim, so Jimmy began to teach him. And what did we see? A good volleyball player and cyclist, Jacky suddenly became a puppet. Not only in the river, but also on the bank when he was only approaching the water, his movements became unco-ordinated and angular. He grew tense, and tension is the bane of learning any new form of activity.

Tension is a frequent state during the first stages of learning. It leads to lack of confidence in apprentices, flying students, chauffeurs, young teachers, actors, etc.

"You have no idea what an evil muscular cramps and various spasms are for the creative process. When an actor gets cramps in the legs, he walks as though paralysed. When cramps affect his arms, the latter grow numb, become like sticks and move like turnpikes. Similar cramps occur with all their consequences in the spine and the shoulders. In each case they deform the actor in their own way and hinder him from playing. But it is worst of all when the cramps seize the face, disfigure, paralyse and immobilise it," wrote K. S. Stanislavsky about this condition of an actor.

Jacky wanted to get rid of his tension, but couldn't, and his tension, on the contrary, increased. I then decided to help him with my advice which may also prove useful for you, Dear Readers.

"All this," I said firmly, "is the result of your lack of self-confidence and fear of drowning. Go into the water up to your chest, take a deep breath and try to dive and bring up a pebble from the bottom."

The boy started diving zealously, but the water kept expelling him to the surface. He learned through personal experience that a person can float and that he drowns only because of fear after swallowing a lot of water. Jacky ceased to fear water, acquired self-confidence, his tension disappeared, and he soon learned to swim.

BOREDOM

We missed the train and had to wait about 3 hours for the next one. This has happened to most people, and most people know how boring it is. We, too, felt bored at first, but our boredom disappeared as soon as somebody asked, "But what is boredom?"

"Let's watch some of the people also waiting for the next train," one of us suggested.

We all acquiesced and began to exchange opinions.

Here was a mother of a large family fussing with her children: changing the diapers of one, wiping the nose of another, anxiously watching two more who kept running away. I didn't think she was bored, although she anxiously awaited the arrival of the train. As for her two older boys, they were so restless and the surrounding world was so interesting, that there could be no question of boredom.

In the corner there was a girl reading a book. One couldn't tell from the looks of it whether it was a textbook or a novel, but the girl seemed to be absorbed so that she could not be bored either. Those two young fellows playing pocket chess also appeared far from bored.

Occasionally we glanced at the young couple whose eyes were riveted to one another; these two probably wanted to wait for the train forever, for that train would only part them. They certainly could not be bored.

But that young man sitting with a blank expression on his face, staring at one point, was undoubtedly bored. Suddenly he shook up and began to read... the tariff, but soon started staring at one point again and yawned. Next to him was a young woman looking absent-mindedly about her and paying no attention to her little daughter who kept whining:

"Mum, will the train come soon? M-u-u-u-m, will the train be here soon?"

These last few people were bored.

What is boredom, then?

Let us imagine again that we could see what was going on in the brains of these people. In those who were not bored we would see brightly burning foci of excitation determining their cortical neurodynamics. In the mother and her enterprising children the foci of excitation would move across the cerebral cortex faster than in the others, but the cerebral cortex would be in an active state in all of them.

But in those who were bored we would see a dark spot of inhibition spreading over the cortex. The whining girl would show a barely luminous focus, flaring up slightly each time she asked her irksome question.

Having assumed a comfortable posture that venerable old man is sleeping the light sleep of the old. The tired-looking woman in working clothes is apparently also very sleepy, but cannot fall asleep because of her uncomfortable position. The cortical dynamics of these people is like that of the people we have already described. Yet they are not bored, but merely sleepy. Nor is any of us bored when we go to sleep at night.

The feeling of boredom is experienced when the rested cerebral cortex gets no stimuli from the external world, while the cortex has a focus which determines expectation of something. It is this focus that distinguishes the cortical neurodynamics of the bored from that of the merely sleepy. Boredom is in some measure related to expectation. It is always connected with a desire to change the conditions and to obtain a chance for vigorous activity.

Grave patients are therefore usually never bored, but convalescents, on the other hand, are always bored.

The richer a person's inner world, the less he is subject to the feeling of boredom because such a person can easily fill the period of forced idleness with some interesting pursuit.

BIRTH OF FRIENDSHIP

In the world of living beings there is a bitter struggle for existence. One of its forms is mutual aid. The expedience of mutual aid is confirmed by the fact that it is consolidated in most diverse instincts. Mutual aid is the most typical of gregarious animals. But it also occurs in the form of symbiosis—a mutually advantageous living together of two organisms of different species—among vastly different species. The actinia makes its home on the shell in which the hermit crab lives. It protects the crab with the stinging cells on its tentacles and feeds it with the remnants of its food, while the crab transports it from place to place.

When the herd of anthropoid apes began to develop into a human collective the instinct of mutual aid gradually began to transform into a feeling of friendship. This feeling uniting two or several, and at times many individuals is engendered by common aims of activity and common interests, is manifested in a striving for mutual aid and is experienced as an attraction for each other, as a desire to go through life together. The community of world outlooks, i.e., the views of life, and of dispositions, i.e., feelings engendered by the conditions of life, strengthens the friendship.

Friendship is enriched by emotional memory which reproduces the jointly experienced feelings. And, as we have already pointed out, pleasant



THE HERMIT CRAB AND THE ACTINIA—EXAMPLE OF MUTUAL AID

feelings are retained in the memory longer and are reproduced more vividly than are unpleasant feelings.

Joint studies, work in the collective, hiking and athletic games engender friendship among the youth. And everybody knows how strong battle-friendship is; it is never erased from the memory of people who fought together in war.

When we see a friend after a long parting our attitude to him is inseparable from the recollections of the feelings which had coloured our joint activities. Try to recall your best childhood friend and trace the concrete aims and deeds that formed your friendship and the manifestations of your friendship, and you will see that all that is said here is applicable to it. Even now, as you think about your friends, you recall not only your feelings for them, but also the feelings which you experienced jointly.

HOW AVICENNA KNEW WHAT AILED THE PRINCE

Abu Ali ibn-Sina, better known as Avicenna (980-1037), famous Tajik physician, philosopher, mathematician and poet born in Bukhara, was summoned to treat the young prince. The prince was wasting away before everybody's eyes, lost his sleep and appetite, and became indifferent to everything and everybody. Avicenna guessed that the young man was hopelessly in love. He took his hand so that he could feel the pulse, and asked the prince's retinue to name the city blocks, then streets, then houses and then the people who lived there. Finally he said:

"Everything is clear now. This young man is in love with the daughter of so-and-so who lives in such-and-such house, such-and-such block, such-and-such street, and his medicine is a meeting with the girl."

The prince was married to the girl and was thus cured.

About 1020 Avicenna wrote the following in his famous *The Canon* (a system of medicine):

"Love is a disease like an obsession and is similar to melancholy. Determination of the object of love is one of the means of treatment. This is done as follows: many names are repeatedly called while the hand is held on the pulse. If the pulse changes very much and becomes, as it were, intermittent, then by repeating and checking on it several times you learn the name of the sweetheart. Then streets, houses, trades, occupations, genealogies and towns are similarly called, each of them in combination with the name of the sweetheart, while the pulse is watched; if the pulse changes on repeated mention of one of these signs, you collect from them information concerning her name, attire and occupation, and learn who she is. We tried this method and obtained information which helped us to establish the person of the sweetheart. Then, if you do not find any other

treatment, except intimacy between them sanctioned by the faith and the law, carry it into effect."

The pulse is a very sensitive expression of man's emotions. It was not without reason that more than 2,000 years ago the Greek physician and naturalist Hippocrates could distinguish about 60 different characteristics of the pulse. Ilya Faddeyevich Tsion, Pavlov's teacher, jokingly, but with good reason, said that with the aid of a cardiograph a dying rich man could learn with accuracy the degree of sincerity of his heirs' grief.

By recording the flyer's pulse in flight (and now it can be done telemetrically) it is often possible to determine the flight element which presents particular difficulties to a flyer.

The continuous pulse records of Yuri Gagarin made during the first space flight gave objective evidence of his great self-control.

WHAT IS LOVE, THEN?

A great deal has been written about love. That is why there is no need going into this emotion here. I shall therefore only touch upon the psychological aspect of it.

Love is a feeling. Man experiences love as his attitude to somebody or something, i.e., the object of his love. This feeling may differ for different things in the same person. Man feels differently about fruit, icecream and chops, music and volleyball, a doll and a kitten, his brother and his grandmother, his son and his grandson, his hometown and his country. I have intentionally united different objects of love in groups, to show that this feeling also differs within each group.

Now you are probably expecting me to tell you about love for a friend, about the love of Romeo and Juliet, Anna Karenina and Vronsky. But first let us see if there is anything common to all cases in which man says, "I love."

This common element in love is man's desire always to have the object of his love near him, and his fear of losing it. Another common element is the comparableness of the intensity of this feeling with respect to different objects. Everybody usually knows what he loves more and what less, although perhaps not always at once.

All objects of love may be divided into two groups. One group consists of those with respect to which the feeling is exhausted by the aforesaid. The lover is concerned only with himself. The other group includes the objects with respect to which the lover is overwhelmed by a desire not so much to receive as to give, even if the giving is to the detriment of the lover, i.e., is a sacrifice. In some languages the word "love" refers only to this latter group, while the word "like" is reserved for the former.

But the love under consideration differs from the feeling for other objects in that it is very deeply rooted in life on the earth, in the instinct of perpetuation of the species. This instinct is inherent in both man and animals even as they have the same sense of hunger and thirst. But I have already mentioned that hunger satisfied with the aid of a fork and knife differs from the hunger which was satisfied by swallowing raw meat.

Love varies even more markedly.

Engels wrote: "Our sexual love differs materially from the simple sexual desire, the eros of the ancients. First, it presupposes reciprocal love on the part of the loved one; in this respect, the woman stands on a par with the man; whereas in the ancient eros, the woman was by no means always consulted. Secondly, sex love attains a degree of intensity and permanency where the two parties regard the non-possession or separation as a great, if not the greatest, misfortune; in order to possess each other they take great hazards, even risking life itself.... And, finally, a new moral standard arises for judging sexual intercourse. The question asked is not only whether such intercourse was legitimate or illicit, but also whether it arose from mutual love or not?"

Is there such a thing as "love at first sight"?

Of course, there is. Love may grow out of friendship, but may also develop from attraction arising at the beginning of acquaintance and then being reinforced by friendship. Both ways are legitimate, but it is more difficult to be mistaken in love which has developed from long-existing sympathies and has stood the test of time; this love is usually more durable. On the other hand, if the attraction arising at first sight is subsequently not reinforced by friendship, it may melt like smoke without developing into love.

Love, like friendship, grows and becomes consolidated under the influence of habit. Good and proper relations in a family strengthen and consolidate love precisely because they make it a habit. The unconditioned reflex feeling is intensified by a conditioned reflex feeling, and man's love, as all his emotions and all his activities, is strong not by its unconditioned, but by its conditioned reflex components.

All aspects of the feeling are harmoniously combined in profound and intense love, and this is its psychological essence. By comparing what I have told you about love with the "love stories" you know from life and literature you will gain a better insight into this question yourself.

Chapter 9

VOLITION

"I DO NOT WANT" AND "I MUST"

"Volition is not some impersonal agent in charge only of movement; it is an active aspect of the mind and the moral sense," said Sechenov.

Volitional processes are characterised by specific efforts aimed at surmounting the obstacles which hamper the attainment of a conscious aim.

All of man's activity is voluntary. It is that which distinguishes human activity from the behaviour of animals. Remoteness of aims, their social significance, persistence and resolution are the things that determine the high qualities of volition. It is sometimes said that the strong-willed swim across the sea of life, while the weak only bathe in it.

The simplest volitional process is a volitional act which achieves an elementary aim. Its stages may be represented by a diagram shown in the picture printed here.

The struggle of opposites is most commonly the struggle between "I do not want" and "I must". Repeat the experiment with falling onto the pillows. Above we needed it in order artificially to produce an emotion. But it shows, as clearly, the struggle of motives, the struggle between the "I do not want to fall" and "I must fall". Some people cannot make themselves fall for a long time and manifest indecision. Sometimes they look as if they are about ready to fall, but then straighten up again.

Indecision is observed not only in the overcoming of the sense of fear and not only in the struggle between "I do not want" and "I must", but also in the struggle between the different "I want". A person walks up to a soft drinks booth and cannot make up his mind whether he wants water with or without syrup. People will say that "he does not know his own mind".

Hamlet's monologue, the opening words of which have become a saying, shows the struggle of motives at the other end of the complex scale of motives of human activity.

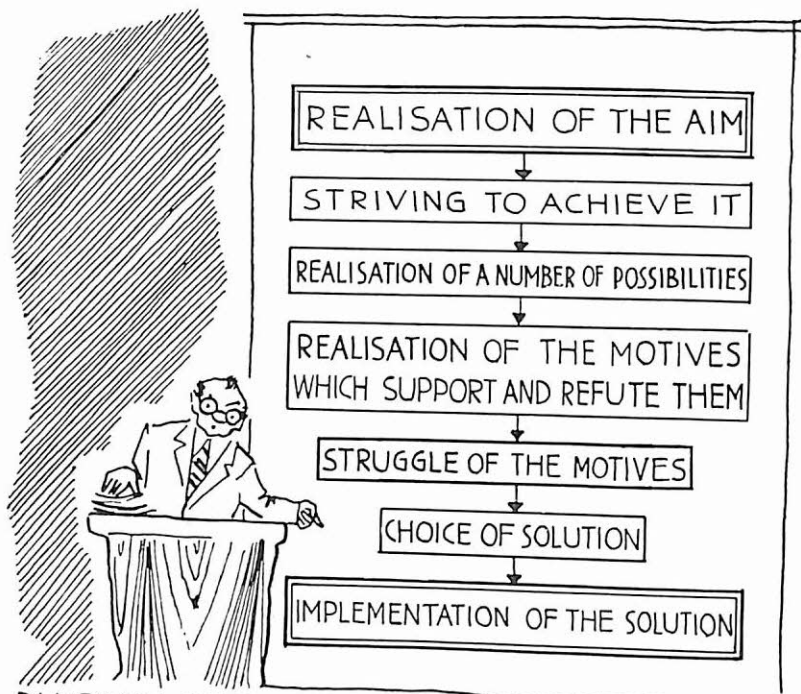


DIAGRAM OF THE STAGES OF A VOLITIONAL ACT

*To be, or not to be: that is the question.
Whether 'tis nobler in the mind to suffer
The stings and arrows of outrageous fortune,
Or to take arms against a sea of troubles,
And by opposing end them?*

To satisfy his "I want", man can sometimes do wonders, but for his "I should like to" he won't even stir a finger. "I should like to" is always weak-willed, like a whim, i.e., an objectively unjustified wish. It may engender stubbornness, but never persistence.

BURIDAN'S ASS

Buridan had an ass. Going away Buridan left enough hay in the manger, on the right and left of the stall. But since the hay was the same in both bunches the ass could not decide which bunch to eat and thus starved to death.

This fabricated story is ascribed to the French philosopher Buridan who lived in the 14th century. However it was known before his time to Aristotle (384-322 B.C.) and Dante (1265-1321). The story about the "Grey one who starves to death between two bundles of hay," as Dante wrote, was cited to prove "free will in asses" who in an analogous situation do not perish. The famous German mathematician Leibnitz (1646-1716) who argued that Buridan's ass had no free will (in other words that his behaviour was determined by external conditions) wrote that "the vertical plane which divides the ass in half lengthwise cannot at the same time divide the universe into two exactly equal halves. Thus in the ass and outside him there has always been a good deal of that which, remaining imperceptible to us, would force him to turn to one side rather than to the other".

The behaviour of animals is determined for the most part by instincts. Man's activity is much more complexly determined by environmental influences. Free will is no longer the "world enigma" it was for people who decided metaphysically such questions as either man has a divine soul which possesses free will, or man is irresponsible for his actions and is like Buridan's ass.

Modern psychology conceives freedom of will in the light of dialectical materialism as recognition of necessity.

Freedom consists not in imaginary independence of the laws of nature, but in their cognition and the possibility thereby of using them in a planned manner to attain definite aims. Freedom of will is none other than the ability to take decisions with full knowledge of what one is doing.

CLICHÉ

Stepping on to the stage and asking one of the spectators to be her partner the girl wrote something on a scrap of paper, folded it carefully and said:

"I am going to perform an experiment in telepathy. Take this note and hold it in your fist," she said to her partner. "Now quickly call numbers divisible by 3. Simultaneously, while continuing to call numbers, listen to me and quickly answer my question. One! Two! Go! Name some domestic bird. Continue calling numbers. Now name some fruit.... And now—part of the face and some Russian poet. That'll do. Now read what I wrote in the note you are claspings in your fist."

Her partner read the note aloud:

"Hen, apple, nose, Pushkin."

Much to everybody's surprise those were the words he had just called.

Try this experiment with people who do not know it, and you will rarely get other answers. This has, of course, nothing to do with "tele-

pathy", but is a matter of determinism, i.e., determination of all natural phenomena, as also of all of human activity by the accumulated experience and the environment previously affecting our brain. We have established very strong conditioned connections, elementary associations since very early childhood. In most cases they are similar in all people. That is why, when you hear "domestic bird", you recall by association, first of all, the hen; the word "fruit" you associate with the apple, etc.

The foregoing experiment is interesting in that it helps to gain a better understanding of "free will". Each participant of the experiment is free to name any domestic bird, for example, a guinea-fowl, but the answer is determined by the fact that in the consciousness domestic bird is associated with the hen much more frequently than with any other bird.

The distraction of attention by quick counting and tightly clenched fist is conducive to manifestation of precisely these, strongest connections and not any casual or specially invented ones in order to appear unique.

It will be observed, in passing, that real literature brooks no ordinary associations. The cliché similes, like "emerald grass" and "sings like a nightingale", are used by untalented or merely inexperienced writers.

SUGGESTED ANSWER

Here is a problem for you: how much does a brick weigh if it weighs 1 kg plus as much as weighs half a brick?

Many people will decide that the brick weighs not 2 kg (incidentally, this is what the brick does weigh), but 1.5 kg, which will have been suggested by the coincidence of the words: "weighs 1 kg" and "weighs half".

Here is another problem. Close the column of figures given below with a sheet of paper and, gradually moving the paper down, add aloud the resulting sums: "one thousand, one thousand and forty, two thousand and forty", etc.

1,000
40
1,000
30
1,000
20
1,000
10

Most people will conclude by saying "five thousand". The psychological reason is the repetition of the word "thousand".

IMITATION

Ask somebody quickly to call three names beginning with "S", like Smith, Stone and Sloan. If this is the way you put it, most people will begin with Smith.

If you ask somebody to name three fruits, like apple, pear and plum, the fruits will be named beginning with apple.

While talking to people, fix your tie so that your interlocutors see it, and most of them will also involuntarily fix their ties. It is a well-established fact that should somebody cough in the silence of a concert-hall a wave of coughing will run through the audience.

It has long been observed that pupils sometimes imperceptibly to themselves take over from their favourite teachers their general demeanor, manner of speaking, various gestures, expressions and even intonations.

All these examples are explained by imitation, involuntary imitation, to be exact. Imitation is rooted in the distant past. In animals it is one of the manifestations of the gregarious instinct in the struggle for existence. In man imitation may also be voluntary and very useful. Aspiration to an ideal is also one of the forms of voluntary imitation.

CORRECT SOLUTION

I was standing on the airfield, next to the commander of the flying regiment, when the pursuit-plane flyer N. stopped his take-off before leaving the ground, turned sharply and taxied to a side. When we reached him he had already climbed out of the plane. Pale and touching his visibly trembling hand to his helmet he reported:

"Comrade Colonel! I stopped my take-off because a hare had crossed my way. I know it's stupid, but it's a bad omen. May I take off again?"

I did not know what the regiment commander would do. He couldn't encourage a superstition and cancel the flight. Nor could he send on a combat assignment a flyer (this happened during the Great Patriotic War) whose will was undermined and who was clearly nonplussed. Letting him fly would mean not only dooming the flyer to certain defeat, but also strengthening the superstition and making others believe in this omen, for "wasn't N. shot down after a hare had crossed his way?"

And the regiment commander after some thought (as I found out later, the same thoughts as mine had also crossed his mind) found the correct solution. Giving the flyer a look full of contempt, he commanded:

"No flight! You don't deserve it. For your act I order you to the kitchen to peel potatoes for 5 days. That will give you enough time to think about omens. You are not fit for better work now!"

N. ended the war as a Hero of the Soviet Union.

The words "I know it's stupid" show that the flyer's act revealed more superstition than prejudice. Although both are usually closely related in their manifestations, they are psychologically different. A prejudice is dominated by wrong, erroneous thinking, a superstition—by an emotion. Lenin said that "ignorance is closer to truth than is prejudice", but it is sometimes harder to overcome a superstition than a prejudice.

PERSISTENT OR STUBBORN?

The Soviet flyer and Hero of the Soviet Union Alexei Maresyev is known and loved for his persistence in overcoming all difficulties and attaining his aim.

But stubborn Keraban, the Turk from Jules Verne's novel of the same title, had travelled around the Black Sea and had also surmounted many obstacles, but only in order to avoid paying the penny toll for crossing the Bosphorus. Ivan Ivanovich and Ivan Nikiforovich who had had a falling-out did not stop short, as N. V. Gogol tells us, of any ordeal in order to spite one another. Many obstinate people have been described in literature.

Stubbornness is inexpedient persistence. The aim for which an obstinate person sometimes surmounts very substantial obstacles does not objectively justify his actions. Moreover, he himself has very little interest in the aim; it is more important for him to gain his object despite all reasons and circumstances which make his behaviour absurd. The most important thing is that the behaviour of a stubborn person is often based on a well disguised motive: "that's the way I want it".

Obstinacy, as a trait of character, is sometimes the result of inertness of the nervous processes typical of a particular person. But much more often it is due to upbringing, the habit of doing as one pleases. It is not so difficult to make a stubborn person persistent. To do this, he must merely be helped to find a worthwhile aim.

DIFFERENT FORMS OF FEARLESSNESS

Courage, bravery, daring, fearlessness and manliness are high human qualities. These words are inscribed on many pages of the history of the Lenin Komsomol (Young Communist League of the Soviet Union).

These synonymous terms are not always easy to distinguish, and are often confused (or used interchangeably) in literature and in everyday life.

Let us try to gain a better understanding of them.

Everybody knows that a fearless person is not only he who in a dangerous situation experiences no fear, but also he who experiences fear

and acts as he deems it necessary just the same. Nobody will consider a person courageous if he foolishly, without the least understanding, rushes headlong into danger. But there are three very different forms of fearlessness.

"A courageous person is he who knows that there is danger ahead, but defies it just the same," said Xenophon, Greek historian who lived in 430-355 B.C.

Bravery is connected with the emotional experience of fighting excitement and entrancement with danger. The brave like danger.

One may be daring and brave in the pursuit of any aim, even in one's own interests. Among American gangsters, at least on the screen, there are many daring and brave people. But one may be courageous only in the pursuit of an aim one realises to be socially useful. In a courageous person fear is displaced by a sense of duty.

Heroism displays various aspects of the personality, some of them predominating in particular cases. In addition to courage, daring or bravery, heroic deeds are the result of a person's world outlook, his high political consciousness, moral fibre, high principles, conviction of his rightness, patience, initiative, resourcefulness, determination, discipline,



UNPRECEDENTED OPERATION



self-control, strong will (as resistance to the impact of a single blow) and fortitude (as resistance to the impact of subsequent blows). Heroism is always active and is manifested in activity.

The heroism of Soviet people is based on the communist world outlook and the realisation of their duty and responsibility to the nation and the homeland.

This happened in 1961 in the centre of Antarctica, at the Novolazarevskaya Station. The wintering party included Leonid Rogozov, a physician. As luck would have it, it was he who fell ill with appendicitis. The physician could easily have helped any of his 12 companions should any of them have had this disease, but not one of them was able to operate on him.

He knew that without an operation he would not only die, but would also leave the wintering party without a physician, since no planes can reach Novolazarevskaya in Antarctic winter. And he opened his own abdominal cavity, excised the appendix and applied the necessary sutures.

COMMON CAUSE

The American workers who in 1932 helped to put the Gorky Automobile Plant into operation could not understand how Chempalov, the smith who worked on forging crankshafts, not only taught the best methods of forging to the smiths, whom he was emulating, but rejoiced at their successes and grieved over their failures.

"But this simply isn't normal—to rejoice that you were beaten and that you turned out to be worse than the others," one of them argued with me, and his voice betrayed not only surprise, but also an unconcealed feeling of his own superiority.

Another worker, a devout catholic and a very kind and industrious person, tried to understand Chempalov and maintained:

"He is simply a very good Christian and therefore sacrifices his own interests and lives only for others."

Those were two typical representatives of the past—representatives of mankind living under conditions of profound contradictions between the personal and the social. Some of them—the majority—lived for themselves. Others—the protesting minority—lived for others, but to their own detriment. Life for oneself engendered envy or self-satisfaction, life for others spelled doom.

The class society has made it impossible for them to live for the common cause and to organise for this purpose their own lives and the lives of others. This possibility was created only by socialism which eradicated the contradictions between the personal and the social and called socialist emulation into existence.

The envy, which had not yet grown into emulation, was not a survival for the American workers who had come to the Gorky Plant for money, but was in keeping with the social conditions under which they had been reared. But for a young Soviet worker a feeling of envy for the one whom he emulates is a survival of the past. This means that his will is aimed not at common interests, but at his personal interests which are at variance with the common cause. This means that his will cannot be called socially-trained. The example of Valentina Gaganova* and of a large number of her followers vividly attests that their will is socially-trained.

STRENGTH OF IDEA

While attempting to kill Porsena, the king of Clusium who besieged Rome in 508 B.C., Mucius, a Roman youth, was taken prisoner by the king's Etruscan troops. Enraged, the king ordered a fire to be kindled in the altar to torture the youth in order to make him name his accomplices. Mucius proudly approached the altar and put his right hand into the fire. While talking to the king he held his hand in the fire until the hand was charred. Amazed by the deed of the young Roman who showed the will-power of his nation the king released him and lifted the siege. The image of Mucius, named Scevolus (lefty) has gone down in world literature as a model of volition which had overcome everything.

We do not know whether Mucius Scevolus overcame his pain or simply did not feel any pain. It may be physiologically assumed that the focus of his second signalling system connected with the thoughts about the greatness of his homeland, which he voiced, was so strong that, according to the law of negative induction, it inhibited the focus which registered pain.

Look at the faces of the men so skilfully sculpted by F. D. Fiveisky. The one on the right is overcome with pain, but he won't give up. But the one in the centre is showing such hatred for the enemy and such contempt in his eyes that it may be assumed that he feels no pain.

It is well known that Walter Scott dictated his works while affected with a very painful disease. It took all his will-power to make himself speak. Fascinated by particularly animated dialogues he would jump out

* Valentina Gaganova, a weaver from the town of Vyshny Volochok. Temporarily giving up her high earnings she left her advanced work team and joined a backward team in order to communicate her experience and knowledge to the as yet inexperienced young workers. Following her example thousands of advanced Soviet workers have gone over to the backward sections of production, where their help is needed more.—Ed.

of bed and run about the room, completely entering the role of his characters and forgetting his pains. He thus wrote half of his *The Bride of Lammermoor*, all of *The Legend of Montrose* and almost all of *Ivanhoe*. I am mentioning it here because, despite all the differences in the content of the feelings, in its neurodynamic mechanisms this case closely resembles the foregoing cases and renders them more comprehensible. A strong focus of excitation in the cerebral cortex makes it possible not only to overcome pain, but also not to feel it.

DELAYING DEATH

The bomber was attempting a landing clearly in violation of all rules. Heavily hitting the ground it ran along the airfield and listing on one wing stopped with the motors stalled. We rushed over to the plane.

All members of the crew were lying without any signs of life. The pilot sat covered with blood and holding the stick. His feet were pressing on the brakes. It was evident that he had struck out at the ignition switch with the last movement of his wounded hand to stop the motor and prevent a fire in case of a bad landing. His face showed enormous strain, attention and volitional effort.

About 20 minutes later, at the medical station, the flyer came to. Without any change in countenance he uttered through his clenched teeth, "The order was carried out... How's the crew? Is the plane intact?" and fainted again.

In another half an hour he came to again. And this time we heard from him with the precision of a tape-recorder:

"The order was carried out... How's the crew? Is the plane intact?"

Upon hearing that the crew was alive (although the navigator and gunner were dead) and the plane intact the flyer said contentedly, "O.K." His face softened, then got distorted with pain, and the flyer began to writhe and moan.

Severely wounded he piloted the plane to the airfield. The concern for his men and the plane was so strong that the focus of excitation associated with it in the cerebral cortex inhibited the pain and prevented total loss of consciousness in the air. The plane was saved as a result. This focus was so strong that it did not become extinct even later at the medical station after the flyer had lost his consciousness twice. It was possible to extinguish it only with tranquillising words, after which this focus disinhibited the formerly inhibited areas, and the pain and motor excitement caused by severe wounds made their appearance.

This is not the only case when a volitional effort delayed the loss of consciousness and even death. There is a case on record when a flyer

"detained" death until he landed his plane and died immediately upon landing.

In the 5th century B.C. a Greek warrior had run 42 km from Marathon to Athens and, after reporting the victory of the Greeks over the Persians, dropped dead. The marathon race, one of the modern track events (42,195 m), is run in commemoration of that feat.

During a certain battle a courier galloped up to Napoleon and handing him a message rolled in the saddle.

"Are you wounded?" asked Napoleon.

"No, I am killed," answered the courier dropping dead from the horse.

"I ORDER YOU TO THINK OF LIFE"

"Poplavsky and Fedotov no longer got up, trying to preserve their strength," recounted Anatoly Kryuchkovsky.* And for the first time in the 40 some odd days one of the four lost heart. But maybe he didn't; maybe the soldier merely decided that the time had come to decide this, too.

"How shall we be dying, fellows?" he asked calmly.

"Why," Vanya Fedotov broke the silence, "whoever begins to feel weak and gets to think he is dying, let him say so. We will crawl up to him, embrace him and kiss him 'good-bye'. Let the one who will be dying last write our names with red lead on the walls of the crew's quarters. Let him also write when we were lost, salute to our homeland and greetings to our mothers."

And this is what Corporal Ziganshin said then:

"No smearing of the walls of the crew's quarters! I forbid you even to think about it. We still have three pairs of boots. That will do for all of March, and in March they will find us without fail."

He ordered them to think about life, and the soldiers, who later said about themselves—"that is how we have been trained" and "we did not for a moment forget that we were soldiers," could not fail to carry out this order of the commander of the self-propelled barge "T-36".

Discipline is a volitional skill based on the world outlook and becoming a trait of character.

The report of the commander of the American aircraft carrier *The Kearsarge* of March 7, 1960, contained the following words: "They said they had been in the ocean for almost 50 days. It sounds incredible, but their hair, inflamed red eyes and their tattered clothes confirm their statements. The ship's physician Frederick Backwith noted that they were

* The story about the four heroes was related on p. 13—Ed.

half-dead from exhaustion, but in good spirits, which is amazing. They were on the brink of death, and although they are dreadfully exhausted, they kid each other."

HEROISM

"The same act may be one of duty and one of heroism, depending on circumstances. And, if it is possible to draw a line between them, it will be a very thin one." These words belong to Sivkova, Secretary of the Komsomol organisation of the Dimitrov Collective Farm.

Julius Fučík said, "A hero is a person who at the decisive moment does what must be done in the interests of human society."

There is also the following definition: "A hero is a person who has displayed some kind of fortitude (bravery, daring, courage, self-control, patience, etc.) which is worthy of being handed down to posterity as a precept and for edification." Thus wrote in 1911 Shumkov, the first Russian psychologist who made a special study of this question.

The psychologic essence of heroism was remarkably well stated by Lyolya Kolesova, former Young Pioneer leader of one of Moscow schools. The statement was made before she had become Heroine of the Soviet Union (she was awarded this title much later and posthumously), although she was already a heroine.

It happened on a rainy evening in the autumn of 1941. Several girls—the next day they were to be transported to the enemy's rear—sat near a stove and talked about heroism.

"I wish I could die beautifully," said one of them, "so that a book may later be written about me, and others may imitate my heroic death. That's what I have come here for. I should like to do something heroic."

"And I wish to drive the Hitlerites out of our country," said Lyolya. "Maybe we shall die, but who wants our death? It is they who want us to die before our time, and it's unimportant whether we die beautifully or not. But we want them to die or leave our country. It is worth dying only when you die for a cause, and in that case we will die like real people."

"That's what I meant," said the girl who wanted to do something heroic.

"No, that isn't what you meant. You are dreaming about glory, but I don't care about glory. What I want is to drive the enemy out of our country. Tomorrow we shall be given a plane not at all in order that we may die beautifully at the front-line, but in order that we may carry out the assignment of our headquarters. You remember that!"

EDUCATION OF THE WILL

"We have made a bet, a bet that I will not cry out and will not jerk my hand away if Romashka cuts across my fingers with a penknife. This shall be a test of my will. According to the 'rules for developing the will', I must learn 'not to give external expression to my feelings'. I repeat these rules over and over again every evening, and, at last, here is a good chance. I am going to test myself.

"'Go ahead and cut', I say to Romashka.

"And this scoundrel cold-bloodedly cuts my finger with a penknife. I do not cry out, but jerk my hand away involuntarily and lose the bet."

Sanya from the *Two Captains*, the novel of the Soviet writer Veniamin Kaverin, thus recounts his attempt to strengthen his will. Some people try to "strengthen their will" by similar, sometimes even more absurd and at times even dangerous, undertakings, like walking on ledges and jumping out of second-floor windows.

The will may and must be strengthened by training oneself to overcome all obstacles in attaining a reasonable aim, in which case the training of the will will prove beneficial. Somewhat further in the above novel Sanya says it aptly:

"But then I have learned 'to make my plans for the day in the morning' and have been following this rule all my life.

"As for the main rule—'to remember what I am living for'—I don't have to repeat it very often because this was clear to me even in those years.

"It is nearly 7 o'clock. Time to get up; I promised myself I'd be getting up before the bell. I tiptoe over to the wash-room and do my exercises before an open window. It is cold, snowflakes come flying into the window, whirl, fall on my shoulders and melt. I wash, down to the waist and... take to my books."

Everything that Sanya did to attain his aim strengthened his will. It is precisely because of this purposefulness that the Soviet youth like the book about the two captains so much.

"To struggle and seek, to find and not to give up."

Chapter 10

PSYCHOMOTORIUM

SECHENOV'S DISCOVERY

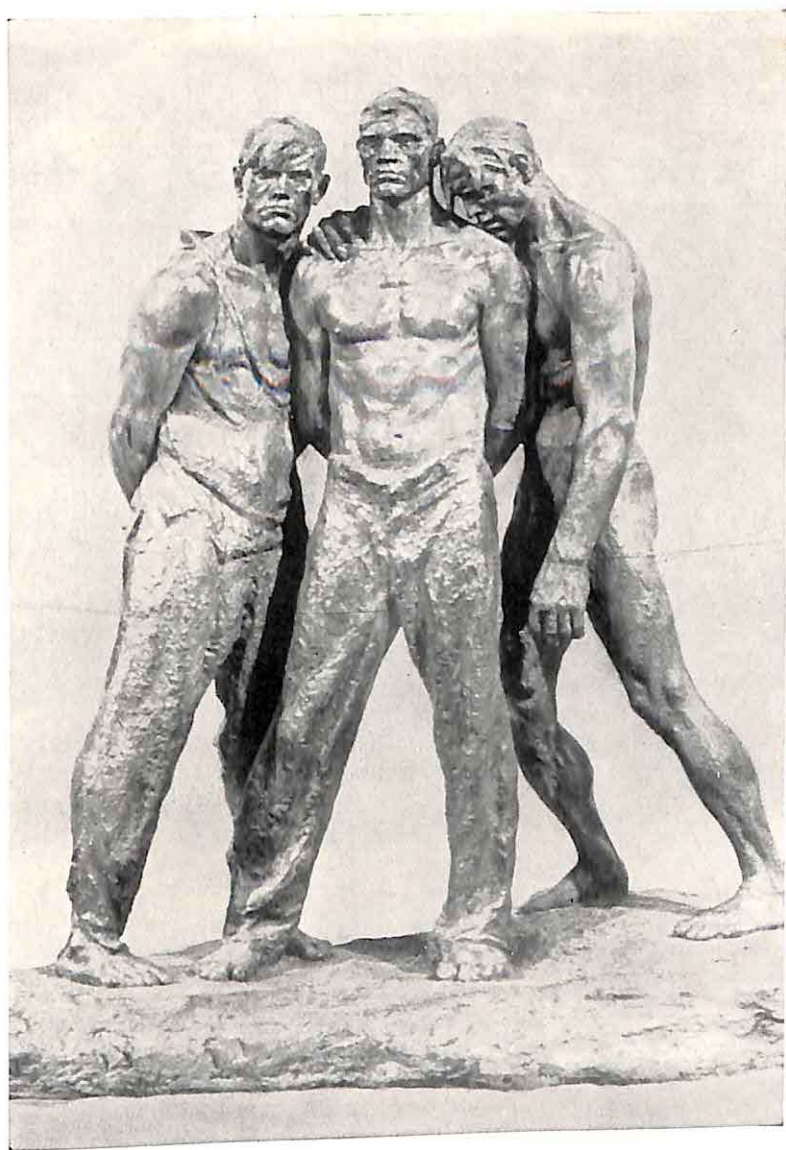
"Whether a child is laughing at the sight of a toy, or Garibaldi is smiling when he is persecuted for his excessive love of his homeland, or a girl is thrilled by her first thought of love, or Newton is discovering universal laws and is writing them on paper, the end result in all these cases is muscular movement," wrote I. M. Sechenov on the opening pages of his remarkable book which he at first entitled *An Attempt to Reduce the Method of Origination of Psychic Phenomena to Physiological Principles*.

However, the censors found this title improper and demanded a new one. In 1863 the book was published under the title of *Reflexes of the Brain*. The change in title did not depreciate its enormous influence on the minds of its contemporaries, and it has forever gone down in history of world science under this title. The book had been written by Sechenov as a long article to the order of the *Sovremennik* (*Contemporary*), a magazine founded by Pushkin and at that time the organ of the progressive revolutionary democracy.

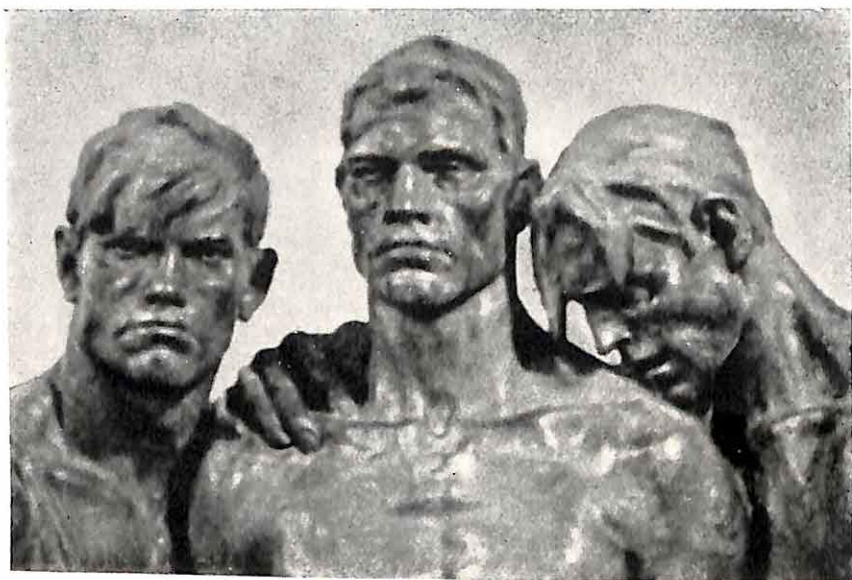
The author finished this work by summarising all he had said with the following challenge: "Let them now say that psychic activity and its expression—muscular movement—are even for a moment possible without external stimulation of the senses." And nobody could refute him.

WORKING MOVEMENTS

"Complex muscular movements are really hardly accessible to analysis as to the composition and activity of the participating muscles. But important in the working muscular movement is not this aspect, but the direction of the movement, its strength (i.e., the pressure or traction



"STRONGER THAN DEATH" (BY F. FIVEISKY)



"STRONGER THAN DEATH"
(FRAGMENT) BY F. FIVEISKY

CHARACTERISATION OF WORKING MOVEMENTS	ACCORDING TO THEIR				
	TRAJECTORY			SPEED	STRENGTH
	FORM	DIRECTION	SCOPE		
REGULAR	APPROPRIATE				
INEXACT	INAPPROPRIATE				
DISPROPORTIONATE			INAPPROPRIATE		
SMOOTH				WITHOUT JERKS	
ABRUPT				JERKY	
VIGOROUS				HIGH	
SLUGGISH				LOW	
WIDE			LARGE		
FINE			SMALL		
FAST				HIGH	
SLOW				LOW	
STRONG					HIGH
WEAK					LOW



produced by the movement), the extension (the length of the way) and the speed—aspects permitting of experimental measurement.” These words are taken from Sechenov’s book *Outline of Man’s Working Movements* published in 1901.

The principal method of increasing labour productivity in the socialist countries is replacement of manual labour by mechanised and automated labour. However, the question of rationalising the working movements raised by Sechenov will never lose its importance. This question is also important in sports, as well as in everyday life.

Working movements are usually characterised by various adjectives—correct, inexact, disproportionate, etc. All these characteristics may be

SPEEDS OF VARIOUS WORKING MOVEMENTS



HAND
IN THROWING

CM/SEC

KM/HR

8,000

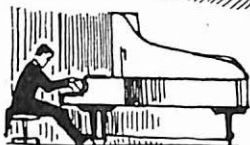
288



RUNNING

1,000

36



FINGERS
IN PLAYING
THE PIANO

800

29



HAND
IN WORKING
WITH A HAMMER

650

23



WALKING

190

7



HAND
IN TRANSFERRING
A PART

150

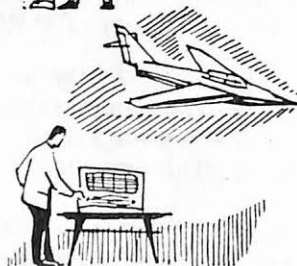
5



HAND
IN FILING

15

0.5



HAND
IN FLYING
A PLANE

5

0.2

FINGERS
IN TUNING
A RADIO SET

0.01

0.0004

reduced to the table shown on p. 241. Try to observe the movements of a working person. This table will help you correctly to evaluate the working movements performed by yourself and by others.

THE FASTEST AND THE SLOWEST MOVEMENTS

Take a sheet of paper and try to make as many dots on it as you can in 30 seconds with a blunt pencil. To prevent the dots from coalescing (in order that they may be counted), as well as to avoid complicating the movements, ask somebody slightly to move the paper about.

Remember that good pianists can strike the keys with their fingers up to 11 times per second when they perform a trill. This is the fastest working movement.

Try to make as many swings with your trunk as you can, as if you were rocking something, pushing with your shoulder or chopping wood. I don't think you will be able to do 25 swings in 15 seconds. This is the slowest working movement which man tries to do as fast as possible. Consciously, however, man may considerably slow down his movements, as is the case, for example, in fine tuning-in of the radio.

We estimate our movements by sight, but by measuring the amplitude of the movements in centimetres, multiplying it by the number of movements and dividing it by the number of seconds we can get the mean rate of movements.

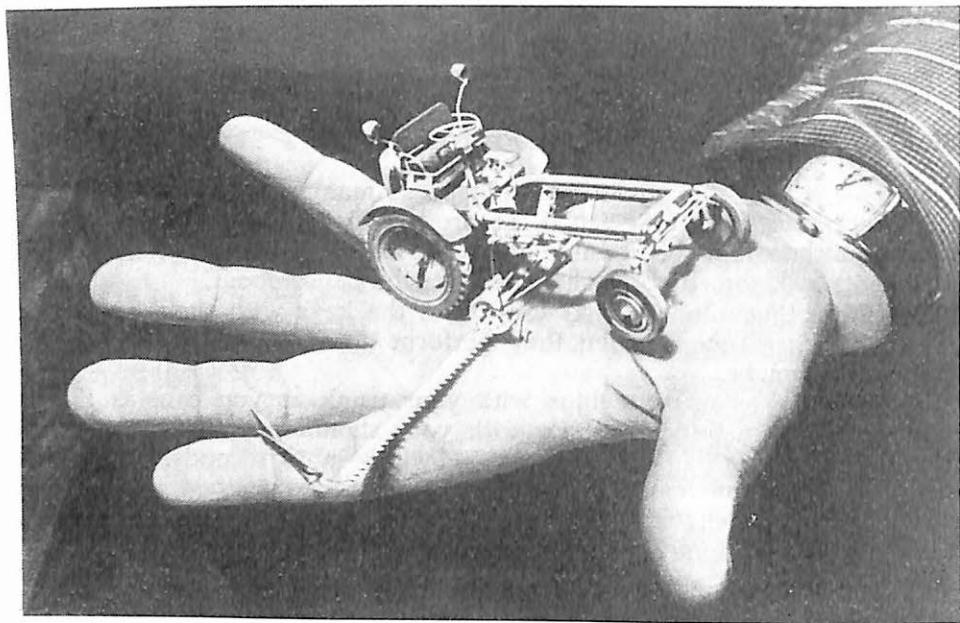
Working movements are studied by very precise methods, particularly by velocity filming.

AMAZING PRECISION

A person is writing a long message on a grain of rice. Just think how precise his movements must be! Ivory-carving requires not only attention and will, but also exceptional control of the hands.

The famous locksmith Khvorov from the village of Pavlovo made locks—24 locks weighing 4.3 g; various parts of these locks were the size of a pinhead. V. I. Lenin cited this in his book *Development of Capitalism in Russia*.

Look at the picture on p. 244. It shows a model of a self-propelled mower made by engineer D. A. Khandros from boxtree with an ordinary knife. It has 1,477 wooden parts. The miniature working Gall's chain connecting the engine and tiny mechanism of the mower consists of 146 parts, and the diameter of the chain is 0.08 mm. The diameter of the wire of the "working" wooden spring is about 0.1 mm. The working parts of the model include a steering gear, a cutting apparatus, Gall's chain and a clutch. The cutting apparatus may be mounted in the working and idling



THIS OPERATING SELF-PROPELLED MOWER WAS MADE OF WOOD
WITH AN ORDINARY KNIFE

positions. Everything is as in a real mower. The box for spare parts contains wrenches and gripping tongs. Although this remarkable craftsman has also made a model of a helicopter of about the same size, he is somewhat inferior to the gunsmith from the Russian city of Tula who, according to legend, shod a flea.

MILLIONS OF MOVEMENTS

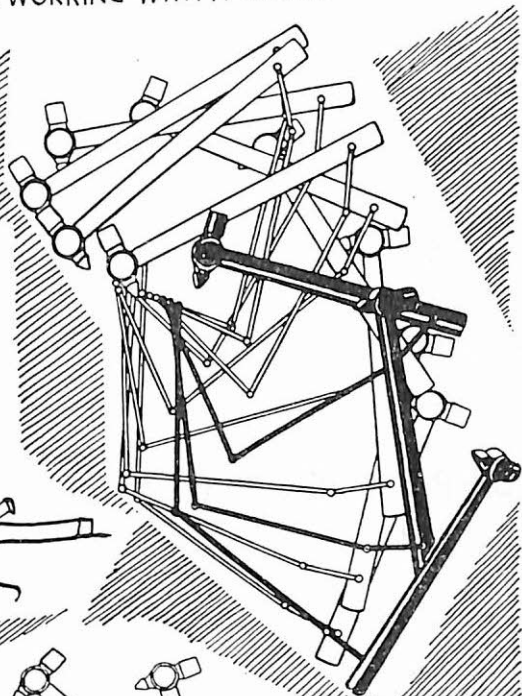
There are machines on which the worker must repeatedly perform but a few movements—take a part, secure it in the machine, press and release the starter, take the part off, and repeat the same movements all over again. And this is done thousands of times in the course of a working day.

A cotton picker cleans out the boll of the plant by hand, performing close to 50 very fine movements. In the course of a working day he performs about three million such movements.

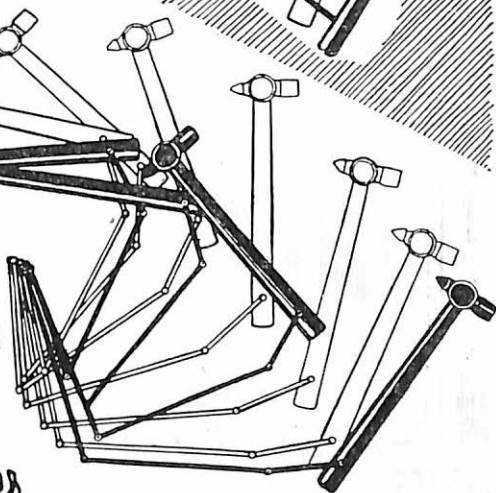
That is why Soviet society devotes so much attention to mechanising cotton harvesting, as well as other labour-consuming manual operations.

DIAGRAM OF THE MOVEMENTS OF THE HAND AND HAMMER
IN WORKING WITH A CHISEL

APPRENTICE



MECHANIC



WHITE HAMMER-SWING, BLACK HAMMER-STRIKE, INTERVALS-1/15 SEC

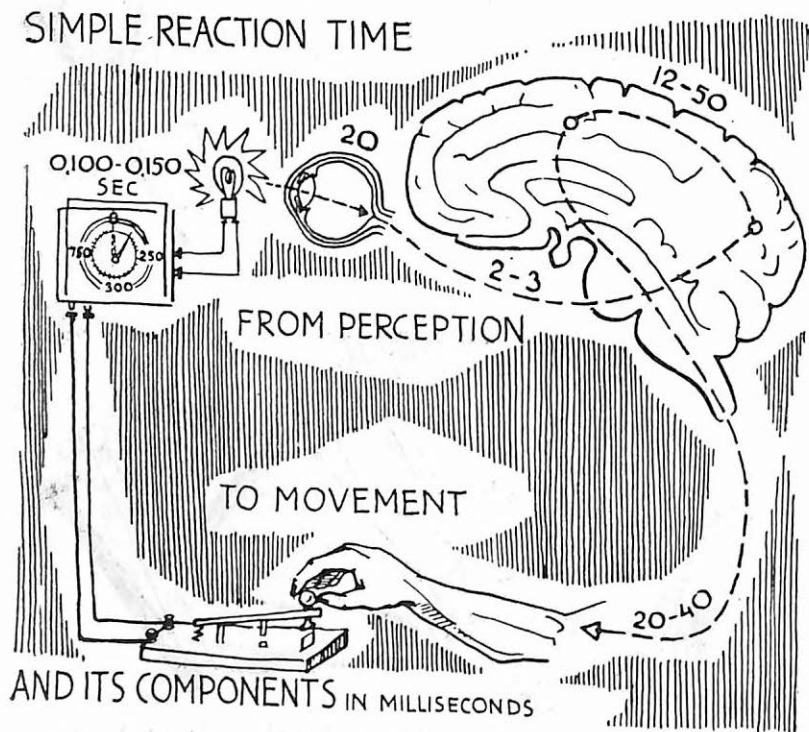
PERSONAL EQUATION

In 1795 the head of the Greenwich Observatory N. Maskelyne dismissed the young astronomer Kennbrooke because he was half a second late in marking the passage of a star through the meridian. Maskelyne found the errors of Kennbrooke's calculations by comparing Kennbrooke's data with his own, which he, of course, considered infallible.

Thirty years later (truly, better late than never!) the German astronomer Bessel restored Kennbrooke's reputation by showing that all astronomers, including Maskelyne and himself, mark the time erroneously and that every astronomer has his own mean time error. Since then this time is being included in astronomic calculations as a coefficient named the "personal equation".

The history of studying the rate of a simple motor reaction is believed to have started with that case.

However, the personal equation is not the rate of a simple reaction, but the precision of the reaction to a moving object, since an astronomer may



be not only late, but also too fast in marking the time when the filament in the objective seems to cut the luminary in half.

A simple motor reaction, sometimes given the abbreviated designation of "psychic reaction", is the fastest possible response with a simple movement known beforehand to the suddenly appearing, and also known signal.

The simple reaction time, i.e., the time from the appearance of the signal to the moment the motor response begins, was for the first time measured in 1850 by Helmholtz. It depends on the analyser acted upon by the signal, the strength of the signal, and man's physiologic and psychologic state. It is usually 100-200 milliseconds to light, 120-150 milliseconds to sound, and 100-150 milliseconds to an electrocutaneous stimulus.

Neurophysiologic methods have made it possible to break this time up into several parts, as shown in the illustration.

REACTION VELOCITY

The simple reaction time differs in different people. It also varies in you, depending on whether you are tired or rested. The mean reaction time typical of a person is called his *reaction velocity*. That this velocity differs in different people may be established by a simple experiment.

The "equipment" in this experiment is an ordinary broom. For hygienic reasons the broom should be washed well before the experiment. The broomstick must be well polished to prevent splinters. Make pencil marks on the broomstick at distances of 1 cm from each other. The last mark should be made 15 cm from the bottom.

The experiment requires an experimenter and a subject who may change places. The experimenter stands on a chair and grasps the top of the broomstick with two fingers. The subject holds his hand on the level of the lowest mark, half flexing his fingers without touching the stick. The experimenter says, "Attention!" and several seconds later unclasps his fingers. The subject must grasp the falling stick as quickly as possible.

The experiment is performed 15 times with the number of marks to which the stick had dropped recorded each time. The first 5 measurements are discarded, as used for acquaintance with the conditions of the experiment, while the other ten form the basis for calculating the arithmetical mean which is compared with the similar indices of other subjects. Experiments performed with both the right and the left hands show the reaction time to be shorter for the right than for the left hand.

Do this experiment before and after a long walk and you will find that fatigue increases the reaction time. After practising this stunt for

several days you will discover that in the process of training the reaction velocity increases. Lastly, by studying the reaction velocity of volleyball, tennis and pingpong players and of persons engaging in no sports at all you will convince yourself that sports accelerate the reaction.

SLAPPING GAME

The widespread slapping game has several variants.

One of the players places his hand on the table and tries to jerk it away when another player suddenly attempts to slap it. In another variant the right hand is placed in the left hand of the slapper. In still another variant—the most complex one—both hands are placed in the open palms of the slapper. Quickly withdrawing his hands the slapper must slap the hands of his opponent. If the opponent succeeds in jerking his hands away he becomes the slapper.

In this game the speed of movement competes with the reaction velocity of the players. If the players do not develop the gambling spirit, the game is useful because it trains the psychomotorium and volition.

Let me advise you how to play the last variant without ever losing.

Before slapping, warn your opponent:

"I am going to slap this hand," and even shake that hand a bit to make him understand which hand you are going to slap. But you must slap before finishing the last word.

If you use this method, your opponent will never be able to jerk his hand away because he will involuntarily wait for the end of the sentence and his attention will be focussed on your words, which will at the same time make him somewhat tense.

If not all three, at least one of the causes will come into play, and you will win.

AT A CROSSING

Driving out of an alley and turning to a deserted crossing the chauffeur suddenly saw a yellow traffic light. He became alert although he didn't yet know what he was to do next. If the traffic light changed to red, he would have to step on the clutch and put on the brakes. If it changed to green, he would have to keep driving and pressing on the accelerator. In such cases one has to react quickly, for one may not tarry at a crossing.

As quickly as the chauffeur may react the latent (concealed, not manifested outwardly) reaction time will be greater than in a simple reaction. In this case the chauffeur's reaction is a complex one, namely, a reaction

of choice, in which the motor response changes according to several values of perceived signals known beforehand.

The choice reaction time ranges from a few tenths of a second to several seconds.

WATCHING A CRANE OPERATOR

There is a bridge crane in the shop. The crane operator lifts or lowers the hook with the load using one lever, moves the crane across the shop with another lever, and, lastly, shifts the whole bridge of the crane along the axis with the third level. In other words, the crane can haul loads along all three axes.

An inexperienced crane operator moves the load successively along each axis, working alternately with each lever. The load moves by fits and starts and in a broken line: it starts, stops, then starts again in another direction. In this case the activity of the crane operator consists of a chain of separate reactions.

An experienced crane operator moves the load along the most economic curve, evenly and simultaneously in three planes. He works with the control levers all the time, which is faster and safer because the load moves without jerks. In this case the activity of the crane operator is built on the principle of sensorimotor co-ordination in which perception and movement seem to be enclosed in a spiral—the perception signals the necessity of making the movement more exact, while the movement taking place alters the picture being perceived.

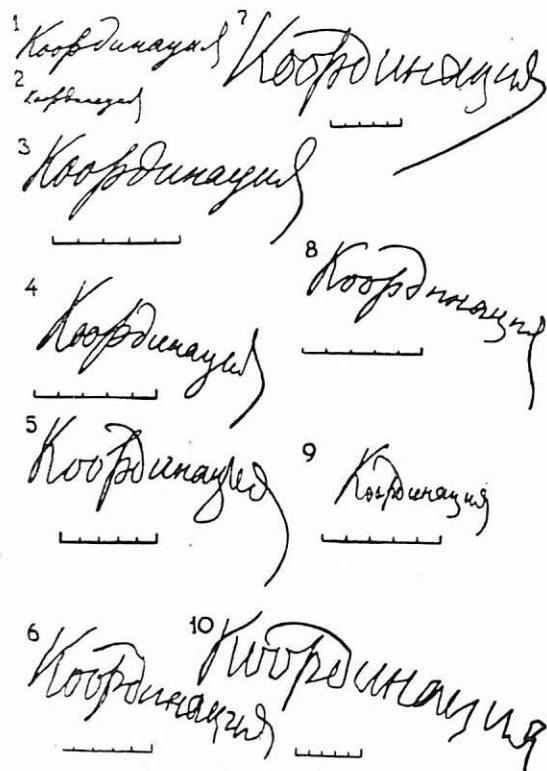
The movements of the chauffeur at the wheel and of the flyer at the control stick are built on the same principle. When you ride a bicycle you don't think how many degrees and where you must turn the handlebars. The action with the handlebars also becomes enclosed in a spiral with the perception of the direction of your movement.

To put it in the language of cybernetics, in sensorimotor co-ordination the working movements of a person are performed continuously, being always rendered more precise by feedback signals represented by the perceptions of the results of the performed movements. Physiologists call these signals sensory corrections.

DIFFICULT CO-ORDINATIONS

Try to write with your right hand a capital "D" on the wall and simultaneously draw a circle on the floor with your left foot. You think it's easy? You will have to practise for a long time before you are able to do it well.

WHATEVER METHOD WE MAY USE TO WRITE



OUR HANDWRITING CHANGES VERY LITTLE

The more biologically expedient a co-ordination, i.e., harmonious combination of several simultaneous movements, the easier and more precisely it is achieved. The more a co-ordination is at variance with biologically established harmony, the more difficult it is.

While walking we swing our arms somewhat sideways in tact with our walk, repeating the co-ordination of the run of our quadruped ancestors. For us it is not difficult, but for a 4-year-old child it is not easy to learn to clap his hands rhythmically and successively in the game of clapping hands.

1. PENCIL HELD AS USUAL
2. THE SAME, BUT FINER SCRIPT
3. PENCIL HELD IN THE RIGHT HAND, BUT MOVING THE WHOLE HAND INSTEAD OF ONLY THE FINGERS.
4. PENCIL TIED TO THE OUTSIDE OF THE RIGHT WRIST AT THE USUAL SITE OF A WRIST-WATCH
5. PENCIL TIED TO THE INSIDE OF THE RIGHT ELBOW
6. PENCIL TIED TO THE RIGHT ARM ABOVE THE ELBOW
7. PENCIL TIED TO THE TOE-CAP OF THE RIGHT SHOE
8. PENCIL HELD IN THE TEETH
9. PENCIL HELD WITH THE FINGERS OF THE LEFT HAND
10. PENCIL TIED TO THE TOE-CAP OF THE LEFT SHOE

Try to rotate your arms in front of you in one direction, towards you or away from you, first in coinciding phases (so that both arms are simultaneously above the head and then at the legs) and then half a swing apart (so that one arm is above the head and the other at the legs). Both these rotations are very easy. But not everybody will be able simultaneously to rotate the arms in different directions, one arm towards oneself and the other one away from oneself. This co-ordination was biologically never needed and must be learned anew.

It is quite easy to learn to tap one's own belly with one hand and simultaneously stroke the head with the other, or to write on a blackboard "3's" with one hand and "8's" with the other. But it is very difficult to do this by alternating the hands.

HANDWRITING

Whether you write with a pencil on a horizontally lying sheet of paper, or with chalk on a blackboard, or with a stick in sand, your handwriting hardly changes. Very few people can change their handwriting. But even if they do an expert will find many common elements by comparing the usual and altered handwriting and will easily reveal the writer. Sometimes this has to be done in crime detection.

Nikolai Aleksandrovich Bernstein, a psychomotorium specialist, asked a certain person to write without preliminary practice one word in ten different ways.

As the illustration on p. 250 shows the handwriting did not change very much (the scale lines in the illustration are 5 cm long).

Try at least part of this experiment and you will find that your handwriting will not change very much. People who have lost the right hand (or both hands) through an accident learn to write with the left hand (or even with a leg or the teeth) and soon almost completely restore their initial handwriting.

TWO TIES

Take two similar ties and ask somebody to tie one of them around his own neck by looking in a mirror and tie it in the same manner around your neck.

By standing beside one another and looking at both ties in a mirror you will usually find that the ties are not similarly tied, but that one of them is a mirror reflection of the other. The person who tied them did not even

notice that his movements, when he was tying the tie around your neck, were entirely different from those he made while tying the tie around his own neck by looking in a mirror. Visual signals are stronger than kinesthetic signals and it is they that determine sensorimotor co-ordinations.

STIR A FINGER

The leading role of vision in sensorimotor co-ordination is easily confirmed by the following experiment.

Cross your hands and join palms. Now interlace the fingers and turn the hands out so that the interlaced fingers are before your eyes. Let somebody show you, without touching you, what finger you must stir.

Your continued mistakes will be due to the fact that you will see the indicated finger on the side of the body opposite to that to which it really belongs.

Now shut your eyes and let the person showing you the finger you must stir touch it, and you will make no more mistakes.

BALANCE

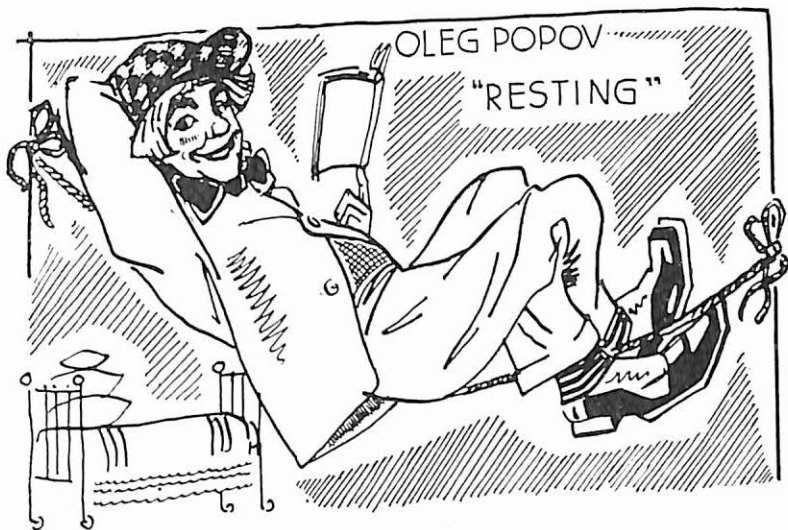
STIR THIS FINGER



If you are a very good—I repeat, very good—cyclist, choose a large, even and free ground, and try to cycle with your eyes closed. I used to do it at one time in dry estuary areas of Western Crimea. Not only in a plane, but even in a glider one does not get such a sensation of flying as in this cycling. Only in my sleep did I “fly” better.

It is possible to ride a bicycle with the eyes closed because in ordinary cycling the sensorimotor co-ordination is effected not only by the visual, but also by the vestibular and kinesthetic analysers.

It is precisely this form of finest sensorimotor co-ordination that underlies those marvels of agility of which very few people are so capable as the circus clown Oleg Popov. He feels as calm



and even comfortable on wire as you and I feel in our own beds. It is not without reason that an artist has jokingly painted him that way. Like other rope-walkers, jugglers and gymnasts, he relies more on the vestibular and kinesthetic analysers than on the visual analyser.

It goes without saying that the stunts performed with such ease are a result of strenuous and persistent training.

IN THE STATE OF WEIGHTLESSNESS

"...Nor do we touch the floor, but assume any position and direction; we stand feet towards the floor, towards the ceiling or towards a wall, i.e., we stand vertically or horizontally; we float in the middle of the rocket, like fish, but without any effort and without touching anything; no object presses on another, if they are not pressed together. An object carefully released from the hands does not fall and if pushed, moves in a straight line and evenly until it runs into another object, which sets it in motion again, although more slowly. At the same time it spins like a top. It is even difficult to push a body without imparting rotatory movement to it.

"We feel good, we are at ease, as in a fine featherbed, but there is a mild rush of blood to the head, which is harmful for full-blooded people. Everything is so quiet, so good, so calm....

"Actually there is no top and no bottom in the rocket, because there is no relative gravity, and a body left without support does not tend to move to any wall of the rocket, but the subjective sensations of top and bottom persist just the same. We feel a top and a bottom, only they change places with the change in the direction of our bodies in space. We see the top in the direction of our head and the bottom in the direction of our feet. In a similar manner our planet appears to be above when we are turned with our heads toward it, or it sinks in an abyss because it appears below us when we are turned with our feet toward it. It is a grand and at first sight frightful picture; but then we get used to it. . . ."

These ideas were expressed by Konstantin Eduardovich Tsiolkovsky as early as 1911 and were based entirely on conjectures. And now Yuri Gagarin, the first man in the world to be in a state of weightlessness for a long time, confirmed in practice Tsiolkovsky's theoretical conjectures.

"The state of weightlessness appeared after the spaceship had been launched in orbit, when the carrier rocket had separated," said Gagarin. "At first it was an unusual feeling, although I had experienced temporary weightlessness before, but I soon got used to this state, fitted myself into the situation and continued to carry out the programme."

This once more demonstrated that for motor acts visual signals are more important than kinesthetic signals.

This was confirmed by Herman Titov who on August 6 and 7, 1961, flew in space for 25 hours and made more than 17 laps around the Earth. At first he felt as though he were flying upside down, but that sensation soon disappeared.

"One can do everything in space-flying," he said; "one can read, write and could probably draw pictures."

Titov was the first man to sleep in a state of weightlessness.

But how did Yuri Gagarin and the other cosmonauts who flew later eat? How did they swallow? Vision has nothing to do with it, has it?

No, it hasn't. But gravity does not play an important part in swallowing, since on the Earth we can eat and drink standing and lying down, prone and supine. True, we have to learn to do it even on the Earth, if we don't want to choke.

Chapter 11

PERSONALITY

FLOWERS AND PEOPLE

As flowers open up under the rays of the rising sun, so will the human personality develop all its potentialities in communist society. However, this comparison is one-sided. Opening flowers cannot hasten daybreak, whereas the new man brings communism closer by his work and by the influences he exerts on other people. Flowers cannot become more beautiful than they are, whereas man wants to improve and can. Flowers, when there are too many of them, smother each other, whereas man in a collective helps the others to become better and more beautiful.

Man, as A. S. Makarenko said, can and must "design the personality"—his own, as well as that of other people.

"OFF WE GO!"

What will the man, who flies to outer space first, be like?

Everybody asked himself this question. That this man had to be absolutely healthy and well trained was clear to all. But what about his personality? Many thought of him as some sort of superman.

Now everybody knows this cheerful, disciplined and modest flyer, ordinary citizen of the Soviet Union and very humane person, the first cosmonaut who inscribed his name in world history on April 12, 1961.

Is there anyone among us who would not want to be like Yuri Gagarin? Or would not want to have such a friend? Yet, he himself showed the way which everybody could follow to become like him. This way is clarity of purpose, excellent knowledge of one's own potentialities, persistent training and the calm confidence they engender.

And that was why man's first cosmic flight could start with the words "Off we go!"

AIM OF LIFE

My inquisitive interlocutors were interested in many things and had quite a few questions to ask me. The characteristic part of it, however, was that none of them, born after the Great October Socialist Revolution in the country on its way to communism, asked me anything about the aim of life.

They, who were reared and bred by the Communist Party—members of the Komsomol—knew since their Young Pioneer days that the aim of their life was to build a new society, to carry into life the ideals for which their fathers and grandfathers had fought. Sometimes I myself had to bring up this question which had agitated the best minds for thousands of years.

Mankind has four answers to the "why live?" question.

Man got the first answer as instincts of self-preservation and perpetuation of the species from his ancestors. The ideology of fascism with its propaganda of unrestrained racism has been preaching the idea of "super-man" in its attempt to turn man back into the lair of a beast. The "ivory tower" to which the "refined man" would like to withdraw from the world is the same, but modernised lair. The "cosy little nest" built after the idea of "my home is my castle" is also a lair.

This is the "private ownership psychology" which the Soviet people are struggling so resolutely to eradicate.

The second answer was given by Christianity. Life on Earth is allegedly a mere preparation for the life beyond. The worse it is here, the better it will be there. Hence, the main aim is patience and forgiveness. It is for this answer given by religion to the question about the aim of life that Marx called it the "opium of the people".

The third answer has been given by those who are against the former two answers, but who do not know the fourth and only correct answer. The third answer was most clearly and consistently formulated by Shakespeare.

*Life's but a walking shadow, a poor player,
That struts and frets his hour upon the stage,
And then is heard no more; it is a tale,
Told by an idiot, full of sound and fury,
Signifying nothing.*

The fourth answer has in some form or other been suggested by those who have dedicated their lives to serving the people. It was given the most correctly by Karl Marx whose teaching, bearing his name, has shown mankind the aim of existence, and each progressive person the aim of his life—participation in the building of the society on whose banner it will

be inscribed "From each according to his ability, to each according to his needs". Great Lenin applied Marxism to the practice of the working-class movement and created a state in which the people have done away with the contradictions between personal and social aims. These people live to build communism. They are building it, and in this they see not only the aim, but also the joy of life. And they will achieve communism.

HAVE YOU DONE ALL YOU COULD?

The example of my young friends with whom I vacationed during the summer in which I finished writing this book showed me how our young people's concrete objectives differ despite the community of their aims. They have different interests, inclinations and aspirations, in other words, different personalities.

Gera is a student of a technical institute; he is very fond of machinery, is working at an engineering plant, is interested in mathematics, and has made up his mind to become a designer. Petya is a medical student and believes surgery to be the leading branch of medicine. Lena is a philologist and a passionate musician. She lives in the world of art. Masha, the Young Pioneer leader, attends an evening pedagogical institute. Sveta and Sergei are secondary school students, but, whereas Sveta has been a young naturalist from the first grade on and has never doubted her career—"anywhere in the country, only with animals"—Sergei has not chosen his life's work yet.

"Each one of you has already done something, while I have not been able to do anything worthwhile," he said sadly.

To be sure, Sergei hasn't found himself yet. "Really to find oneself," said M. I. Kalinin* at a conference of Moscow secondary school students, "means to outline the course you want to pursue in life, to build your character, establish your convictions and find your calling." But the bad part of it is not that Sergei has as yet achieved very little, but that he does not know *what* he has not done yet. Whatever work man has done is already behind him; but a living person is valuable not only for his past deeds, but also for what he can do and strives to do.

I advised Sergei and, while I am at it, am advising all readers to ponder more often upon the questions:

"What haven't I done that I could do today, this month and in general?"

* Mikhail Ivanovich Kalinin (1875-1946), outstanding Soviet statesman, Chairman of the Presidium of the U.S.S.R. Supreme Soviet from 1938 to the end of his life, author of many books on questions of socialist construction and communist education.—*Ed.*

MORAL CODE OF THE BUILDERS OF COMMUNISM

The Programme of the Communist Party of the Soviet Union has established the following basic principles of the *moral code of builders of communism*:

"devotion to the communist cause; love of the socialist motherland and of the other socialist countries;

"conscientious labour for the good of society—he who does not work, neither shall he eat;

"concern on the part of everyone for the preservation and growth of public wealth;

"a high sense of public duty; intolerance of actions harmful to the public interest;

"collectivism and comradely mutual assistance: one for all and all for one;

"human relations and mutual respect: between individuals—man is to man a friend, comrade and brother;

"honesty and truthfulness, moral purity, modesty, and unpretentiousness in social and private life;

"mutual respect in the family, and concern for the upbringing of children;

"an uncompromising attitude to injustice, parasitism, dishonesty, careerism and money-grubbing;

"friendship and brotherhood among all peoples of the U.S.S.R.; intolerance of national and racial hatred;

"an uncompromising attitude to the enemies of communism, peace and freedom of nations;

"fraternal solidarity with the working people of all countries, and with all peoples."

This Code embodies all the best that the finest people have ever dreamed about and fought and died for, the people whose names are emblazoned on the pages of history.

By estimating a person's acts on the basis of the principles of the Code it is possible to evaluate the moral aspect of his personality and by similarly estimating one's own acts one can evaluate oneself.

INCIDENT IN A SCHOOL FOR SPIES

A certain state was training in a special school spies to be sent to countries building socialism. The school administration decided to incorporate a detailed study of Marxism-Leninism in the curriculum of the school, thinking that that would help the spies not only to disguise their intentions, but also to engage in adverse propaganda in those countries.

However, the people behind them failed to take into consideration certain laws of human psychology. It may not be a bad idea to discuss these laws now.

When we say "man" we imply not only a person's organism, but also his personality, a human personality being determined by four very closely interconnected aspects:

- moral qualities, which are the social aspect of the personality;
- temperament, which is the biological basis of the personality;
- individual characteristics of the psychic processes—sensations, perceptions, attention, psychomotorium, thinking, memory, emotions and volition;

- schooling, i.e., the person's knowledge and skills.

A person's moral qualities are the most important traits of his personality, dominating over all its other traits and determining his behaviour. These qualities largely depend on the person's world outlook, i.e., his views and conceptions of the surrounding world, the natural and social phenomena. A person's world outlook is based on his knowledge, but the moral qualities of the personality are determined both by the person's world outlook and moral requirements. A felt need produces a feeling of desire. An active desire included in a volitional act becomes a striving. A striving based on the world outlook and a confidence in its correctness becomes a conviction.

Thus the knowledge acquired by a person and becoming his conviction which encompasses his world outlook and moral qualities may radically alter his moral make-up and, consequently, his behaviour.

And that was what the administration of the school for spies had failed to take into consideration. Some of its pupils, having mastered the theory of Marxism-Leninism and seeing how this theory is being steadfastly and successfully carried into life in the socialist countries not only acquired appropriate knowledge of certain truths, but also changed their convictions. Becoming convinced of the justice of the Marxist ideas they could not go on being enemies of Marxism.

FROM ALL SIDES

A carriage of the underground was "stormed and captured" by a large and noisy group of young people. Standing in the passageway they quite naturally hindered elderly people, invalids and children from getting in and out of the carriage although this was actually a carriage for the latter passengers.

The young people were many, and each of them had his own reasons for such unceremoniousness; it was a manifestation of their personalities. It is not without reason that we say, "There are as many personalities as

there are people," and sometimes even more briefly and aptly: "Each personality is unique."

Some of those young men and young women knew very well that they were violating the rules of behaviour in the underground, but saw nothing wrong in it. Some of them even showed off without understanding that what they were doing was actually misdemeanour. There were some who in virtue of their temperament and in the heat of discussion were unaware of their behaviour. Some were weak-willed and merely imitated the others, and some simply did not know this rule and sincerely believed that the sign—"For elderly people, children and invalids"—was effective only when it was in the first carriage.

Thus this little everyday scene reflected, as the ocean is reflected in a drop of water, the multiformity of human personalities and the main aspects of each personality.

The personality has only four aspects:

Socially conditioned traits of the personality, which include moral qualities, world outlook, interests and ideals.

Biologically-conditioned traits of the personality, which include temperament, instincts, inclinations and basic needs.

Individual characteristics of various psychic processes, which include not only weak volition that we have just discussed, but also all the characteristics mentioned in this book.

The experience of the personality, i.e., the level of its preparation, which includes all its knowledge, skills and habits.

You will always be better able to judge a person if you consider these four aspects.

PUBLIC SHOWERS

Have you ever washed in public showers where the regulation of the hot and cold water in one shower immediately affects the others?

About 20 years ago I not only had to wash in such showers in one of our hospitals, but also happened to see other people washing. It seems to me the diameter of the pipes could have been calculated better, but in those showers it was enough for one person quickly to turn on hot water, to douse his neighbours with cold water, or, vice versa, to scald the neighbours.

There were groups of people who quickly grasped the situation and by common effort set up the "requisite regime" in all the showers. Sometimes a group very soon elected somebody to "leadership". In other cases some person would set himself up as "leader" and very often unsuccessfully. It was particularly bad when there were two or even more such leaders.

It took such groups a long time to fix the showers; sometimes they failed altogether and merely got in each other's way.

Sometimes everything went on normally until some new arrival would suddenly scatter everybody either with boiling or ice-cold water. It was usually a person who never gave a hang about others. In such cases order was quickly restored after his departure. It was not always a bad person who acted in the above manner, but merely one who did not fit in with the rest psychologically.

I shall remember those showers as long as I live, for they very clearly manifested the regularities observed in every group—casual, unformed groups, as well as in collectives.

When I hear of divergences among an aircraft crew, a wintering party at a meteorological station, or a work team, I recall those showers and think that it is high time for psychology to work out a scientific method of selecting such groups, since even in those showers there were groups which were able quickly and reliably to set things going.

CORRECTED ERROR

Hippocrates, the Greek physician who lived in 460-377 B. C., and his followers accounted for human temperaments and diseases by predominance of one of the following fluids in the organism: for persons of a sanguine temperament—by predominance of blood secreted by the heart; phlegmatic temperament—by phlegm secreted by the brain; choleric temperament—by yellow bile secreted by the liver; and melancholic temperament—by black bile secreted by the spleen.

The human temperaments were named later after the Latin and Greek terms for these fluids—*sanguis* (blood), *flegma* (flegm), *chole* (bile), and *melas chole* (black bile). The word temperament is Latin and means a mixing in due proportion.

I. P. Pavlov established the connections between temperaments and types of nervous system determined by the interrelations of strength, mobility and balance of the nervous processes of excitation and inhibition in the cerebral cortex. He wrote: "The types of nervous system established in the dog (and characterised with great precision) may justifiably be transferred to man. These types are apparently what we call temperaments in man. A temperament is the most general characterisation of each individual person, the most fundamental characterisation of his nervous system, and this latter leaves a certain imprint on all the activity of each individual."

The selfsame person may, under different conditions, manifest traits characteristic of different temperaments. On observing how slowly a pupil does his homework and helps his mother one may assume him to have a



FOUR CHARACTERS BY AN ANONYMOUS ARTIST

phlegmatic temperament. But on seeing him at the stadium, when "his" team scores, one will decide that he has a choleric temperament. But at the blackboard he may be taken for a melancholiac. However, if pupils with various temperaments were observed under the same conditions, their behaviour would differ still more.

Temperament manifests itself in the general make-up of the personality, although it does not in any way determine the social significance of a person. Krylov (Russian fabulist) and Kutuzov (Russian general) had a phlegmatic temperament, Peter I (Russian tsar), Pushkin (Russian poet), Suvorov (Russian general) and Pavlov (Russian physiologist) had a choleric temperament, Herzen (Russian public figure and writer), Lermontov (Russian poet) and Napoleon had a sanguine temperament. Gogol (Russian writer) and Chaikovsky (Russian composer) were melancholiacs.

CORRELATIONS				
OF TYPES OF NERVOUS SYSTEM,			ACCORDING TO PAVLOV	
	S T R O N G			W E A K
	C A L M	L I V E L Y	U N R E S T R A I N E D	
STRENGTH BALANCE	STRONG BALANCED	STRONG BALANCED	STRONG UNBALANCED EXCITABLE	WEAK UNBALANCED INHIBITABLE
MOBILITY	INERT	MOBILE	MOBILE	MOBILE OR INERT
	PHLEGMATIC	SANGUINE	CHOLERIC	MELANCHOLIC
AND				
OF TEMPERAMENTS, ACCORDING TO HIPPOCRATES				

A person of any temperament may be clever or stupid, honest or dishonest, kind or malicious, talented or ungifted.

At one time it was believed that representatives of the weak type of nervous system are socially inferior. Several years ago one of the specially studied pupils of a Moscow school was found to have a weak type of nervous system, but this pupil was later graduated with honours. There were people who decided that either the method of determining the type of nervous system was wrong or the school had wrongly conferred the honours. But the most careful check-up showed that the honours had been conferred justly and that the pupil under consideration actually had a weak type of nervous system.

This case helped the well-known psychologist B. M. Teplov to expose the myth of the social inferiority of personalities with a weak type of nervous system, who, although tiring more easily, are more perceptive of the surrounding world and react more keenly to it. This also applies to

animals since, if the weak type did not have the advantage of greater sensitivity and faster reaction, it would long since have been extinguished by natural selection.

However, persons with a weak type of nervous system really cannot be steeplejacks or flyers. But then there are many other occupations.

IN A PRESSURE CHAMBER

A pressure chamber is a steel device from which the air may be pumped out by special pumps. Mountain-climbers training for climbing and flyers before high-altitude flights are examined and trained in these chambers.

I happened to observe two flyers being tested in a pressure chamber. One of them was a calm, balanced person precise and sparing in movements; he always thought before answering a question. The other one was his opposite. Active and lively he never sat still, cracked jokes, asked about the details of the test and at once tried to answer his own questions. The former had a typical phlegmatic temperament, the latter—a choleric.

An amazing change occurred under conditions of rarefaction corresponding to an altitude of 5,000-5,500 m. The phlegmatic person became lively and started telling his mate, who would not listen to him, some joke, laughed in the middle of it, insisted that the pressure be raised as quickly as possible to that corresponding to 8,000m since "everything was fine and dandy". His movements became jerky. However, on taking an experimental psychological test in judgement and memory he often wandered, did not very well understand what he read, although he was quite capable of mechanical memorisation.

The other man soon started moping, became sluggish and lapsed into silence. He did not answer questions at once and on taking notes often repeated the same word. From the material he had been given to read he remembered only some casual fragments and, lastly, turned down the psychological experiment, saying that he was sleepy.

However, both of them retained the characteristics of the personality as a whole and the most important traits of character. Whatever changes the mentality and behaviour depending on the temperaments of these flyers may have suffered in the pressure chamber, the two men did not, of course, become, say, less honest or stingier than before, and did not relinquish their ideals.

MORAL INFLUENCE

The subject in the pressure chamber showed clear manifestations of mountain sickness. There were biochemical and physiologic indications that he might faint at any moment.

But when I told him that the crucial part of the experiment had come

and that this part was particularly important for a flyer he pulled himself together and his indices noticeably improved, although his biochemical and physiologic indices might have become even worse. The understanding of the public importance of the results of the experiment became a moral motive which improved his performance. My words were a moral stimulus, while the entire experiment as a whole was nothing but a "laboratory model" of the very well known phenomenon called moral influence.

TRANSFORMATION

One of my acquaintances, an excellent actor who had played about a hundred different parts, took offence when he was told that he surprisingly transformed in each new part.

"What transformation is it," he said, "if after strangling Desdemona I recite lyric poetry to my wife in the evening or after being stupid in the role of Tartuffe on the stage I win simultaneously three games of chess; I only temporarily live the lives of the characters I play on the stage and remain myself just the same."

But he was only partly right.

There are three (and only three) coarsely-psychic phenomena.

Psychic processes (those mentioned in the headings of chapters 4-10 of this book) are always brief. Sometimes their duration measures fractions of a second, as, for example, a psychomotor reaction, and rarely hours, as a long-continued process of thinking.

Psychologic states may last not only hours, but even weeks. But they, too, are transient, since they have a beginning and an end. A person felt fresh, but then got tired. He may even become overtired, and in this state he may become irritable or, on the contrary, indifferent to everything. He took a rest (or perhaps a cure) and became his old self again.

Personality properties form the third group of psychic phenomena. Of course, they, too, change, especially under the influence of education (and self-education), but not so fast as do states. But many of them sometimes persist from childhood to ripe old age, for example, industry and honesty. Nor do they have to change.

The well-known Soviet psychologist N. D. Levitov who suggested the division of psychic phenomena into these three groups is always angry when they are confused.

"A poor actor," says he, "may present on the stage the external manifestations of the character's psychic process, whereas in a good actor the transformation will produce a number of psychic states, or maybe even all the psychic states typical of the character."

If an actor plays the parts of people with different characters, such transformations will contribute to his all-round development and will enrich

his personality. But a good actor who for a long time plays similar characters gradually acquires their traits himself.

This applies not only to an actor. A person who does not control himself and is in the habit of often being angry will after a while, acquire an angry character, while one who is in the habit of laughing will become jovial.

YOU TREAT ME BADLY

We hear these words very often. In a person interested in psychology these words call forth two questions.

The first and foremost question is—what are psychological relations?

Vladimir Nikolayevich Myasishchev, physician and psychologist who has for many years been working on the theory of relations, holds that "man's fully-developed psychological relations are an integral system of individual, selective and conscious relations of the personality to the various aspects of objective reality".

In this sense only man has relations. K. Marx and F. Engels wrote that "wherever there is any relation it exists for me; animals generally have no 'relations' to anything; for an animal its relations to others do not exist as relations". But note that at the end of this sentence the word "relations" is used in its other connotation, namely, as real and objective relations.

The more many-sidedly a personality is developed, the richer and finer are its psychological relations. Social training includes formation of correct attitudes to actions—one's own and those of other people. We judge a person by the company he keeps. "Tell me about your friends and I will tell you who you are."

A person's attitudes to the higher values of life—his country, work and the collective—characterise the level of his social development.

Myasishchev is not only a psychologist, but also a very eminent Soviet psychotherapist. He says that "the most important problem is to make the patient develop a healthy attitude to his illness."

But the words in the heading also provoke another question, namely: why is the word "badly" used in this sentence more often than the word "well"?

The answer to this question is quite simple. Good relations usually exist in a society where all people are friends, comrades and brothers, for which reason these relations go unnoticed and are discussed less than the exceptions to the rule. Health is also a state in which a person does not feel his health and therefore does not talk about it. But the moment he begins to feel anything wrong, he usually voices his attitude to it, for example, "my left leg has been somewhat bothering me today".

The afore-stated habit is not only unpleasant, but also harmful. We must learn to say more often:

"I feel fine."

"You treat me well."

CHARACTER AND FATE

Ernst Thälmann, the leader of the German proletariat, once said to his comrades: "Whatever course you may pursue in the future the prerequisites for your behaviour are inherent in your character. . . . The history of a person is his character."

But it is just as correct to say that a person's character is formed in his activity, along the "course" he pursues.

The following Chinese saying carries a similar meaning:

*Sow an act and you shall reap a habit;
sow a habit and you shall reap a character;
sow a character and you shall reap a fate.*

And this is how science defines these concepts:

An act is something done or an aggregate of things done, the social implication of which things is clear to the doer.

A habit is a disposition or tendency, constantly shown, to act in a certain way.

Character is an aggregate of the most stable psychic traits of a personality manifested in a person's acts. Character is very aptly defined by the noted Soviet psychologist B. G. Ananyev, namely: "Character is such manifestation of the personality which expresses the main trend of a person's life and is revealed in a mode of action peculiar to this personality."

But "fate" has been invented by weak people; it has been invented to justify their bad acts, nasty habits and offensive characters, and to be able to shift the blame for things on others. "Everybody is master of his own fate" is an apt saying.

HAVE YOU A CONSCIENCE?

One day I happened to hear the following dialogue:

"You have no conscience."

"Have you? Neither you nor I have one; nor has anybody else for that matter. Only poets and people who believe in God talk about conscience."

The latter person was profoundly mistaken. I have an idea that he, too, must have suffered pangs of conscience. He was probably conscience-stricken even while saying this.

Conscience is a person's evaluation of his own acts. Pangs of conscience are a person's feeling of moral responsibility to society for his acts, the feeling experienced when these acts are compared with moral norms. Marxist ethics, i.e., the science of morality, holds that these norms depend on the economic system of society. They differ in the different epochs and in the different social classes.

The landlord who exchanged a peasant girl for a setter pup had no pangs of conscience. Nor were D'Artagnan and his Three Musketeers conscience-stricken when, to defend their "honour", they killed guardsmen in duels. Nor did merchants suffer any remorse when they underweighed their customers.

Man lives in society and learns the moral norms of this society in his childhood. These norms become part of his world outlook and his convictions.

As long as a child does not know what is good and what is bad he has no conscience. An adult may also be unaware that he is violating social norms of behaviour at least in regard to some of his acts. In other cases his knowledge of these norms may not be firm enough for these norms to have become his convictions. Such people are said to be morally uneducated.

It is understood that a person who knows the moral norms of the society in which he lives may not agree with them and may rebel against them. The representatives of the given society will consider him dishonest, but history will judge whether he was right, as, for example, Chernyshevsky* who wrote *What Is to Be Done?*, or wrong.

Dishonest, in the exact sense of the word, is a person who knows the moral norms of society and considers them binding only upon others, and not upon himself.

But, if a person is so educated that he is firmly convinced of the necessity of norms of behaviour and is in the habit of evaluating his behaviour on the basis of these norms then, whether he wants to or not, should he violate these norms, he will suffer pangs of conscience, will feel ashamed and will repent.

Repentance is a wish that the act performed by a person had not been performed. Shame is a feeling of dissatisfaction experienced by a person who acted in spite of his ethical norms. Repentance is always associated with a realisation of the significance and consequences of an act, i.e., with the process of thinking. According to its mechanisms, shame is a conditioned reflex emotion. All this may be true, but bashful people are sometimes ashamed without any reason. A person is sometimes ashamed even of the thought that he may perpetrate an immoral act.

* In this novel the writer gave voice to his socialist ideals.—Ed.

INNER URGE FOR WORK

An old, retired worker, instead of enjoying his well-deserved rest, continues to take part in production conferences and keeps coming to his former shop to help young workers with his counsel. In the U.S.S.R. this is not a single case, but a mass occurrence psychologically based on the inner urge for work typical of a member of the society that is building communism.

This urge may be so great that its satisfaction long supports a physically weakening person, whereas failure to satisfy it leads not only to rapid decrepitude, but often also to premature death.

It is wrong to think, however, that only old people who worked all through life experience this urge. It may (and, we must at once say—also must!) form and manifest itself in childhood and youth.

The urge for work is a property of the human personality and it is formed by work—constructive, persistent, but within one's powers and always necessarily carried to the end.

You may think that I forgot to add the word "interesting". As a matter of fact, constructive and persistent work, but within one's powers and necessarily carried to the end will always be interesting.

PREMATURE CHAGRIN

"If I haven't discovered any particular talents in myself now that I am 16," sighed Sergei, "I'll probably never amount to anything."

He was wrong, although really outstanding musical, artistic and literary talents not infrequently manifest themselves in early childhood. Mozart started playing the harpsichord at the age of four, at five he already wrote music, at eight he composed his first sonata and a symphony, and at eleven—his first opera. Glinka suspended pans in his room and imitated church-bell chimes when he was seven or eight years old. Rimsky-Korsakov had a keen ear for music and a musical memory when he was only two years old.

Three-year-old Repin cut out paper figures, and at the age of six began to paint. Serov modelled at the age of three and began to paint from nature, learning about perspective, when he was six years old. Surikov also started painting as a child, and, as he later recounted, he began scrutinising faces—examining the set of the eyes and the make-up of the features—also when he was still a child. Pushkin started writing poetry when he was about seven or eight years old. Many more such examples could be cited.

But a much greater number of children who appeared extremely gifted, so-called "child prodigies", subsequently turned out to be "sterile".



TANYA FEDKINA'S FAVOURITE PASTIME

At the same time there have been quite a few people who have left a deep imprint in the history of culture and science, although their talent had not come to the fore at once, and in some cases had manifested itself quite late. For example, Vrubel (painter) first displayed his talent when he was twenty-seven years old, and Aksakov (writer)—even later, at the age of fifty.

No less instructive is the example of Chaikovsky. He did not have a perfect pitch, complained of poor musical memory and played the piano with some facility, but not very well, although he had played since childhood. He began to compose music after graduation from the school of law. But despite all this he turned out to be a brilliant composer.

So that at the age of sixteen and even much later nobody has any reasons for saying, "I shall never amount to anything." One may only say, "I do not amount to anything yet."

However, the sooner a person finds his calling, i.e., the kind of work he likes most, the work he wants to do and will do with gusto and successfully, the better. But, to do this, one must have an idea about the different occupations and about oneself, one's own abilities for various occupations.

This is the psychological aspect of the free choice of occupations characteristic of socialist society.

RARE GIFT

One day the Fedkin family had company. Natasha was playing Beethoven's sonata. The guests were intently listening. Suddenly four-year-old Tanya piped up:

"You're wrong! You're wrong!"

"What do you mean 'wrong'?" Natasha asked her little sister angrily.

"You're playing it wrongly," said Tanya.

To everybody's surprise Tanya climbed up on the stool and her little fingers ran over the keys. Beethoven's sonata was resumed. Natasha followed the score and saw that her little sister was playing correctly.

Little Tanya has an amazing musical memory. In two lessons she learned the whole system of musical notation. Her phenomenal gift enabled her to play by heart Chaikovsky's *Children's Album*, Prokofiev's *Old Granny's Tales*, Bach's *Prelude*, Kabalevsky's *Novella*, and works of other composers.

I read the above lines in the *Teacher's Gazette* of February 19, 1963, and fell to thinking. This is undoubtedly a case of a rare musical gift (or musical talent, which is the same thing).

A talent is an inborn pre-condition of abilities which determine a person's especially successful activities in a particular field and single him out among other persons who are learning or engaging in the same activities under similar conditions. But, of course, of no small importance is the fact that every member of the Fedkin family is musical and that little Tanya has lived from her very first days in a world of sounds and melodies.

I fell to thinking about the caution and pedagogical skill it takes to safeguard the talent and the child's soul in order that it may develop tranquilly and freely. I made inquiries. Little Tanya is attending the Central Music School at the Moscow Conservatoire. She is in such hands as to exclude any and all anxiety about her future.

TALENT OR GENIUS?

At exhibitions, concerts and stage presentations one may often hear young people interested in art heatedly argue as to whether a particular artist, musician or dramatist is a genius or only a talented person.

But what is talent? Scientists say that it is a most favourable combination of abilities for a definite form of activity making possible its creative performance. Talent is capable of creating something new. A capable musician plays well, but a talented one, moreover, plays his own way. Talent is always characterised by a highly-developed creative imagination.

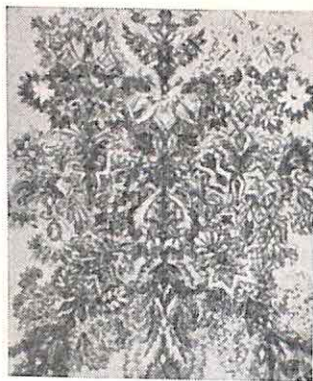
Looking at a picture, even a well painted one, but in its theme and manner of execution resembling many pictures we have already seen and being, as it were, a copy of other pictures, we have no reason to speak about talent with which the artist has painted, yes, precisely painted, it, for he has not created a peculiar, original work and has not thereby made a new contribution to the art of painting.

However, the history of arts knows highly talented copyists. Talent may manifest itself also in copying and parody. Many gifted restorers are working in art museums. Of course, nobody will call their work a "cliché" or "stereotype" just because they skilfully and with unusual precision reproduce what has been painted by others. It is merely a special form of activity, and talent may manifest itself in any field.

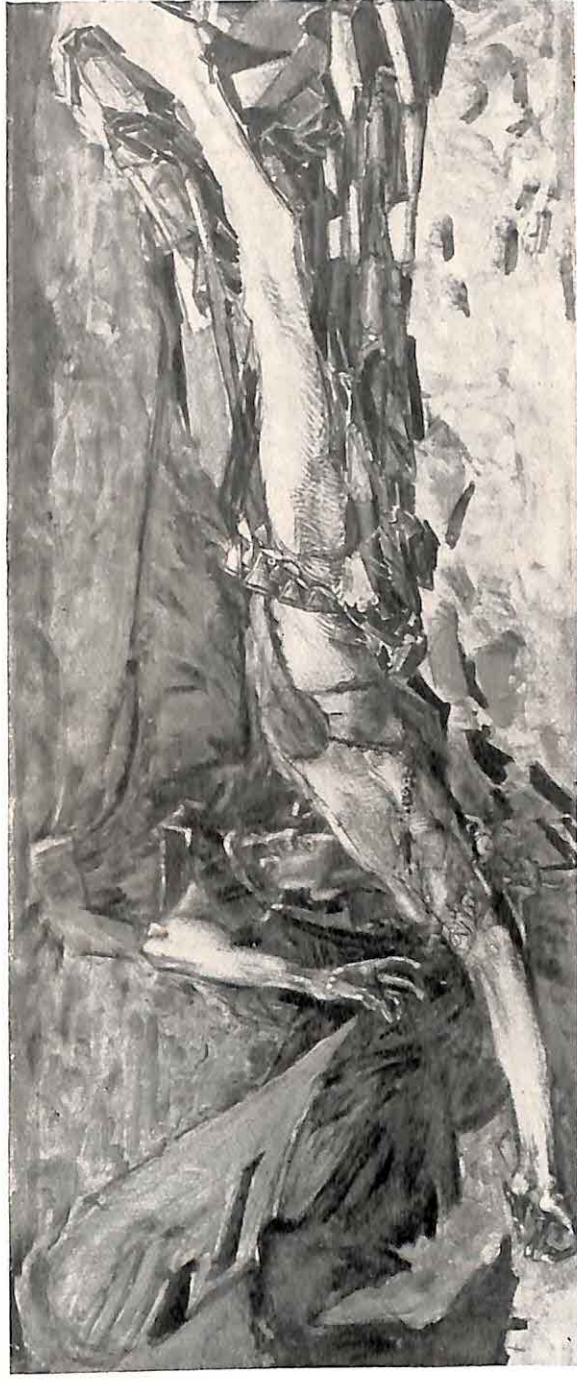
When you argue that some particular composer or artist whom you like is a genius you often display admiration and lack of objectiveness. Of course, a genius is an exceptionally gifted person. But this is not enough. The work of a genius is of historical and necessarily positive significance for society. The difference between a genius and a talented person is therefore not so much in the extent of their endowment, as in the fact that a genius creates an epoch in the field of his activity. Genius manifests itself in the ability to help with the greatest effectiveness in the solution of urgent problems of social development.

By using these criteria you will apparently find it easier to settle the heated arguments usually due to arbitrary evaluation.

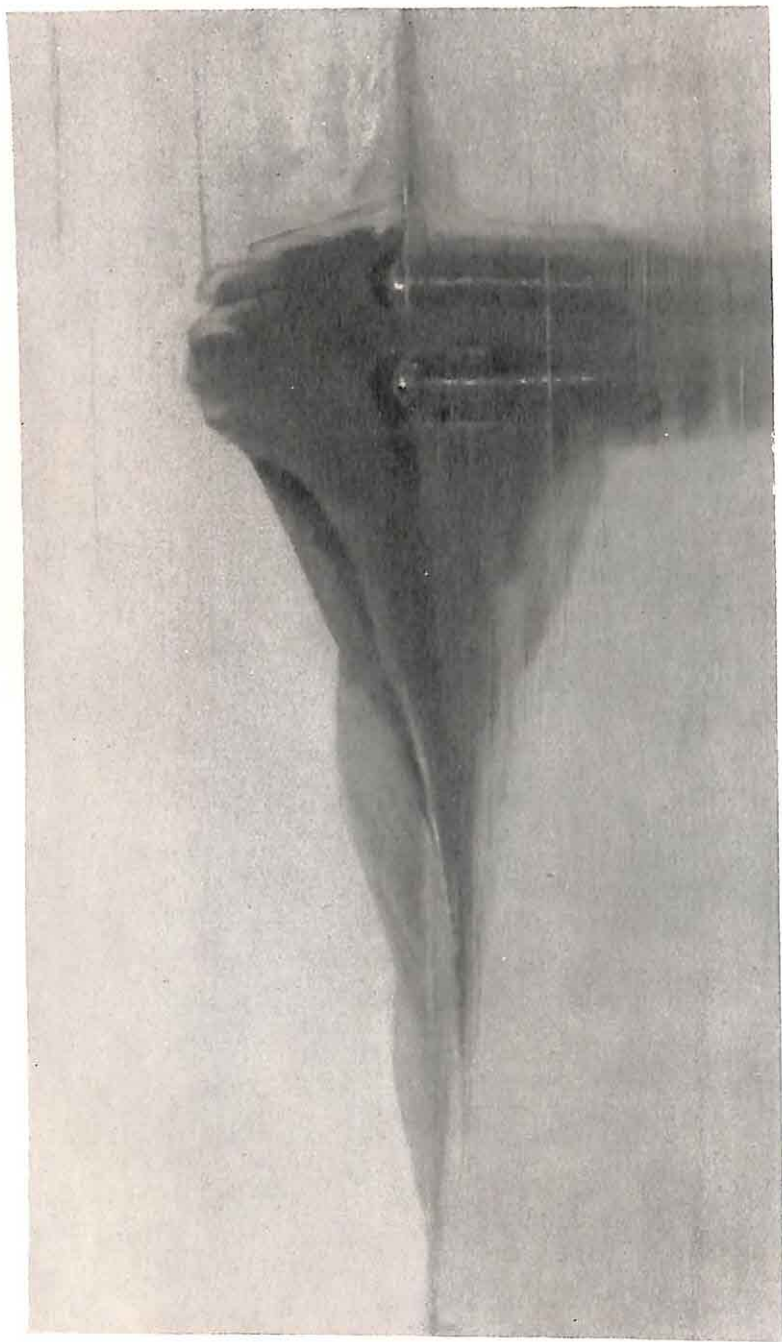
DESTRUCTIVE ANSWER



GRADUAL
WITHDRAWAL
FROM
REALITY



"DEMON" (REPRODUCTION OF A PAINTING BY VRUBEL)



"TRANQUILLITY" (REPRODUCTION OF A PAINTING BY CHURLYONIS)

On page 272 there is a picture of several kittens. The first one is a pretty and quite real kitten. The three middle ones are a gradual abstraction of the first one. The last kitten is completely abstract.

All these kittens were painted by the selfsame British painter Louis Wenn . . . as he developed the schizophrenic reaction. He painted only cats as long as he lived and never displayed any particular talent. The mental disease destroyed whatever talent he did have, as it ravaged his mind and devastated his personality. At the same time his kittens are no worse than the pictures displayed at exhibitions, and his last pictures are such that no juries of exhibitions of abstract art would turn down.

Let us ponder over the question: does such painting enrich or ravage the soul of man?

The easy and logical answer is destructive to abstractionism.

"But what about Vrubel?" may be the question of those who know that this artist ended his life as a mental patient.

"A disease may fail to destroy a brilliant talent, but this does not mean that talent is a disease," is my answer.

HOW TO DEVELOP ONE'S ABILITIES

This question agitates everybody's mind. There are as many concrete answers to this question as there are many different abilities. Abilities always pertain to something, to some definite form of activity. A person with but little musical ability may be a most capable designer or gardener and, of course, vice versa.

According to science, abilities are an aggregate of sufficiently stable, although changing qualities of the human personality, determining success in learning and improving.

Despite the variety of the methods of developing concrete abilities there is a number of general rules.

The first rule is purposiveness. It is apparently first of all necessary to determine what abilities must be developed and in what direction they are to be developed. All the psychological qualities of the personality and, consequently, all abilities develop only in the activity for which they are necessary. It is precisely this that is implied by the proverb—"You learn to swim by swimming." Those who think that it is possible to strengthen one's will without exercising one's volition, to improve one's memory without memorising anything, and to develop fearlessness without having anything to do with danger or risk, but merely by talking about the importance of all this, are greatly mistaken.

The better a person realises the importance of his actions, the better are the appropriate abilities formed in the process of these actions. Memorisation of material without a known purpose does not develop

the memory. The qualities of the personality are improved in the solution of some practical problem "even if the smallest and simplest one" said Lenin to the youth.

Cognisance of the acts being performed is usually associated with a striving to carry out the assignment to the best of one's ability, since the final aim is known and realised. That is why memory will not develop without a check-up on the results of memorisation. This also applies to estimation by sight, ability to observe and other abilities, although not all of them can be with equal ease checked on and evaluated.

The psychological qualities of man form most fruitfully not in one, but in various types of his activity and provided the problems are increasingly complicated. Simple, easy assignments do not develop a person's abilities. An assignment must always be within one's powers, i.e., difficult, but not leading to a loss of faith in one's own faculties and, consequently, to perplexity and overstrain.

An important factor in the development of abilities is repetition and systematic use of the developmental means. Repetition is not only the mother of learning, but also of education. But the main thing is a desire to improve one's abilities and persistence in achieving this aim.

UNSENT NOTE

The young man who was my fellow-passenger in the bus had attracted my attention at the lecture.

I had an assignment to check up on the work of a club and I decided that by attending the lecture which would deal with communist education I should best be able to acquaint myself with the young people.

The lecturer had skilfully and interestingly used the theoretical studies in the problem of education, connecting them with the materials of the industrial enterprise which sponsored the club.

At the end of the lecture my young fellow-passenger diligently wrote a note to the lecturer and then several times tried to send it to him, but each time put it back into his pocket. There is no need telling you how I made his acquaintance and obtained the note that had aroused my interest. Here is what the note read:

"Comrade Lecturer, having got into bad company I became a thief. One day, in order to warm up, I went to the club where you lectured on the Soviet man. Later I read all Krupskaya's, Kalinin's and Makarenko's books that you had mentioned. I did a lot of thinking and decided on the whole, not scientifically, but in my own way that:

"1. The worse and the harder life is, the more often people, willingly or unwillingly, act wrongly, as they shouldn't;

"2. Formerly society was so organised that even good people often had to do wrong;

"3. Now all Soviet people can do right, although it is sometimes difficult. It is difficult when somebody wants to have more than he should or when a bad person is in your way and other people do not see it.

"4. The last and most important: the sooner we have no bad people and the better the people work and treat each other, the better everybody will live.

"This means that one must be a fool not to try to be better.

"This means that one must be a scoundrel to go against himself and against other people out of petty self-interest.

"Please, read my note aloud and tell us whether I have a correct idea of communist education."

I told my new friend that "on the whole" he understood the problem correctly, and I chided him for his failure to transmit such a good note to the lecturer.

ACTIVITY

INCIDENT WITH DOLLS

Margaret Mead, noted anthropologist, recently discovered on one of the Pacific islands a tribe living absolutely isolated from the rest of the world. This tribe lived a very odd life; for example, neither children, nor adults had any idea about dolls.

The dolls she brought and distributed among the children excited the curiosity of boys and girls alike. They began to play with the dolls, as do children all over the world—they dressed and undressed them, nursed them, put them to sleep and punished them for misbehaviour.

It would be logical to assume that the dolls stimulated the mother instinct in the girls and that the boys took to playing with the dolls by way of imitating the girls. As a matter of fact, in half the children the interest in the dolls was temporary and they soon stopped playing. In the other half of the children the interest, on the contrary, increased, and they kept inventing ever new games with the dolls. But despite logic it was the girls who lost interest in the dolls, while the boys continued playing with them.

Incidentally, one of the peculiarities of the islanders' daily life was that the work of caring for the children was assigned by custom to men for they had more leisure since the women were always busy procuring and preparing food.

This case revealed a general, although not always clearly observable regularity, namely: social conditions are more essential in determining human interests, feelings and activity than are man's biological characteristics.

DIFFERENT MOTIVES

"Papa, Mama and Aunt Nadya are not at home. While they are away Grisha, Anya, Alyosha, Sonya and the cook's son Andrei are playing lotto at the dinner-table in the dining-room. They are playing for stakes. The stake is one kopek.

"The children are gambling. The gambling spirit is most intensely written on Grisha's face. He is playing only because of the money. If there were no kopeks in the plate, he would long have been asleep. The fear that he may not win, envy and financial considerations fill his short-haired head, prevent him from sitting still and do not let him concentrate.

"His sister Anya who is about eight years old is also afraid lest somebody else should win. She is not interested in the kopeks. For her to win is a question of self-esteem.

"His other sister-Sonya-plays for the sake of playing. She is equally happy and applauds whoever wins.

"Alyosha has neither self-interest nor self-esteem. He is thankful that he is not being sent away from the table or told to go to bed. He joined the game not so much for the game itself as for the misunderstandings that inevitably arise. It would make him particularly happy to witness a quarrel or even a fight.

"The fifth player-Andrei-is indifferent to gain and the other children's winnings because he is immersed in the arithmetic of the game and its simple philosophy, namely: there are so many different numbers in the world and how come they don't all get mixed up."

These excerpts from Chekhov's story *Children* show how the selfsame activity may be evoked by different motives.

We have already repeatedly mentioned the importance of motives in human activity, but we have not as yet given their definition adopted by the science of psychology.

A motive is something that prompts a person to act. The motives may be requirements, interests, aspirations, feelings and thoughts. It is very important to know what a person wants to do and is doing, but it is still more important to know the motives that prompt him to do what he does.

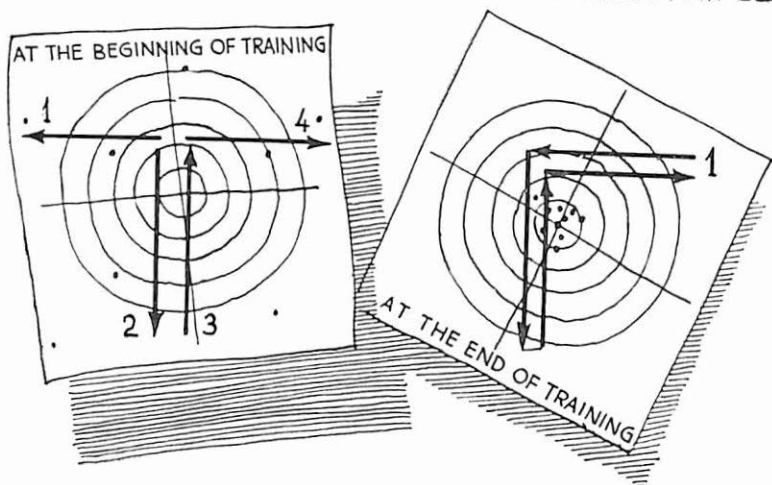
AT THE PLANT AND IN THE SHOOTING-GALLERY

The controller of the plant manufacturing small-bore sport rifles spends his day checking on whether there are any wasters and whether or not the rifles reload well. His activity is essentially determined by this duty.

Activity is such interaction between man and his environment in which man seeks to achieve a conscious aim.

When a sportsman starts learning to reload a rifle he often whispers, "One-turn left, two-pull, three-push, four-turn right." For him reloading a rifle is also an activity consisting of four separate conscious aims, which he keeps repeating. Four aims-hence, four acts.

ACTS PERFORMED WHEN RELOADING A RIFLE



An act is a psychological element of activity achieving a concrete, indivisible and conscious aim.

When an experienced rifleman fires single shots, the reloading of the rifle is an act uniting four formerly independent acts into a more complex one. But when the aim is to fire, as fast as possible, the whole cartridge clip, the reloading is no longer an act, but only a way of performing a still more complex act—speed-firing.

Well or poorly, but anybody can reload a rifle even after the first explanation, but in learning to fire a person does this many times, practising and improving this ability, so that reloading becomes one of his skills.

A skill is an act which forms and changes its psychological structure in the process of practice. The longer and more assiduous the training, the more automatic the acts. I have not fired a rifle for a long time, and because of this long interruption I have probably partly lost this skill; it is no longer automatic.

The analysis of reloading a small-bore rifle applies to all skills in general, and not only to motor skills, such as firing, cycling, operating machinery, but also to sensory (which include, for example, estimation by sight) and mental skills (which include reading).

A SKILL IS AN ACTION FORMED IN PRACTICE



IT IS NOT HARD TO LEARN MIRROR-WRITING

MIRROR WRITING

Sit down before a mirror and screening your hand and paper with a sheet of cardboard try to write and draw by looking into the mirror.

At first draw simple figures on the paper and try to trace them, then begin to draw and write. Be sure to notice that the movements to and from yourself, as well as from right to left and vice versa, are easier than oblique movements which require more complex co-ordinations and which we have already mentioned.

During the first stages of the experiment all your movements will require not only voluntary attention, but also thinking. What is more, you will no doubt talk to yourself, and not only under your breath, but sometimes also aloud. In the course of practice the skill of mirror writing will become automatic and after a while, sooner than you may at first expect, you will write easily by looking into the mirror.

CRAFTSMANSHIP

When I was young I was taught to shoot by a remarkable hunter whom we all called "teacher". He was a fine shot and preferred to hunt with an automatic small-bore rifle rather than with a shotgun. With that rifle he shot on the fly not only ducks, but also woodcocks. Sometimes he missed—

which, of course, may happen to anybody—but, at any rate, less frequently than I did with my shotgun.

We have already noted the skills that enable a master to do things which are entirely beyond other people. Let us recall Oleg Popov, the clown who changes clothes while lying on a single wire. In addition to being highly automatic his skills are also extremely plastic.

"A true master is he who can work with a knife as with a saw and with a saw as with a knife," said Benvenuto Cellini, the famous Renaissance Italian sculptor, jeweller and writer. But Cellini himself had started as an apprentice, although he later outstripped his teacher.

SIMILAR MOVEMENTS—DIFFERENT ACTS

"Please, kill the mosquito on my left cheek, my hands are dirty," asked Sergei while doing something with his bicycle. "Thank you," he said to Masha who had complied with his request.

Nobody else noticed this episode until I called their attention to it.

Masha, who was a teacher, would not have earned the gratitude of either her pupil or the principal of the school had she become angry and, forgetting all pedagogical rules, taking the liberty with a movement of the same trajectory, speed and force (see the picture on p. 241) had struck a slow-witted pupil on the cheek. Her movement would have been noticed by everybody and nobody would have justified it.

But, if Masha used the same movement to slap an insolent fellow in a park alley, we would all justify it.

Even if we assume that the girl's movements were mathematically identical in all three cases, her acts would have been entirely different.

SIMILAR ACTS—DIFFERENT MOVEMENTS

On the same occasion I asked Sergei to ride his bicycle as straight as possible over a narrow board of the bridge near which we were sitting; I also asked the others to see if he did it well. Several minutes later he did it again at my request.

"Has he done it the same way both times or differently?" I inquired.

According to general opinion, he did it exactly the same way both times.

But neither Sergei, nor the others had noticed that during his first ride he had held the handle-bars, as usual, at the ends, whereas the second time he turned his hands out and held the handle-bars in the middle. Then: the first time he had got onto the bridge with his right pedal uppermost;

the second time—with his left pedal uppermost. The first time he had sat straight in the saddle; the second time he rode sharply leaning forward. It follows that he performed the same acts by very different movements.

This can be observed any day in any human work and it shows that we must not identify, as we sometimes do, man's movements with his acts. Acts are only performed by movements; a movement realises the act.

STRUCTURE OF AN ACT

The vacationists at the holiday-home past which we were driving were playing *gorodki* (kind of skittles). This game fascinates not only the players of all ages, but also the spectators. It is not without reason that I. P. Pavlov was an inveterate *gorodki* player.

We stopped to look. A tall, well-built young man was the best player; he never missed a single throw. Carried away by his playing we failed to observe one of the peculiarities of this particular game, namely: the person who put up the figures clapped his hands over them and quickly moved aside.

It turned out that the best player was blind.

In this case the aim of the acts and the movements were the same in the blind man as in the players with normal vision. The difference was in perception to which they all reacted: the blind man—to auditory perception, the rest of the players—to visual perception. It follows that the psychological structure of these acts was different just the same.

The psychological structure of an act consists in the aim and motives, interests and difficulties experienced during its performance, definite organisation of the attention, various manifestations of perception, memory, thinking, the psychomotorium and generally all other aspects of the mentality, which in their interaction determine the quality of performance of a particular act.

USEFUL AUTOMATION AND HARMFUL AUTOMATISM

The expression "to make the skills automatic" is very popular, but is wrong. If we do that, we will do the wrong thing. Fortunately this is impossible. However automatic a skill, its performance is nevertheless under the control of consciousness.

Automatism implies acts performed by man without participation of either consciousness or will. The clearest example of automatism is the

behaviour of a patient suffering from sleepwalking or somnambulism (from the Latin *somnus*—sleep, and *ambulare*—to walk) which was formerly and without any reason ascribed to influences exerted by the moon. A somnambulist automatically performs customary and externally expedient acts for several minutes and even hours. However, these acts are not called for either by the conditions in which the patient finds himself or by conscious aims. He leaves home usually getting dressed first, or sometimes undressed, and walks along narrow ledges with an agility of which a person conscious of the danger is incapable. He will just as unconsciously kindle the stove with his favourite books. According to its mechanisms somnambulism may very aptly be called motor dreaming.

In his book *Studies in Optimism* Ilya Ilyich Mechnikov thus describes a somnambulist: "...The girl gets out of bed and climbs to the attic. She opens the window which gives on the roof, steps onto the roof and walks along its edge... She enters through another window and descends the stairs. She walks about noiselessly, her movements are automatic, her arms hanging along the somewhat inclined trunk; she holds her head high and fixed, her hair is undone and her eyes are wide open. She looks like a fantastic apparition."

The following parasitic words may serve as an example of automatism in healthy people: "you know", "you see", "you don't say", etc.

There are also motor automatisms. I knew a professor who involuntarily stuck out the tip of his tongue whenever he was immersed in thought. He knew that people laughed at him, but he did it without being cognisant of it. Many more examples of automatism may be cited, but not one example of useful automatism in man can be mentioned.

IS ALL REPETITION THE MOTHER OF LEARNING?

Take a copy-book lined with squares, close your eyes or better still, put a bandage over your eyes and, holding your hand suspended, draw a line about ten squares long. Do this several times. Let somebody act as controller, and, if you draw such a line five times in succession (excluding fortuity), let him announce your achievement. To make sure that it was not a fortuity and that you have really learned to draw a line of the given length, make an intermission for a few minutes and draw three more similar lines.

If you succeed in doing this, please, let me know, for the case will deserve mention in scientific psychological literature. But I do not expect to get such information from anybody. The skill will not develop if the result of the performed act is unknown; nor will anybody be able to

develop it this way even with enough paper and patience for many thousands of repetitions; even 20,000 repetitions, as was done in one case.

Now change the conditions of the experiment. Each time you have drawn a line with your eyes closed look at it, evaluate your mistake and repeat the attempt, trying to correct it correspondingly. You will need only a few dozen repetitions to form this skill. It will be somewhat more difficult, but you will undoubtedly be able to develop this skill if you do not open your eyes, but the controller tells you the extent of your mistake—two squares longer or one square shorter, etc.—after each attempt.

INVOLUNTARILY

"When we ran from our car to shelter, one of our comrades, a sedate person, seeing a low-flying German plane suddenly snatched from under his belt a hand grenade and swung it at the plane. Another comrade grabbed him by the hand. He had really intended to throw the grenade at the plane. But he came to at once and laughed together with us," wrote A. Fyodorov in his book *The Underground Regional Party Committee Is Functioning*.

This is an example of an impulsive act, i.e., an act performed without the control of consciousness, without realisation of the methods and chances of achieving the aim. This is peculiar human behaviour, greatly simplified in its psychological structure, usually with vivid emotional colouring—behaviour in which instinctive acts sometimes very oddly interweave with quaintly altered "fragments" of conscious acts.

Impulsive acts are always manifestations of loss of volitional control over one's own acts and must therefore be checked.

CROSSING THE STREET

When crossing a one-way street, after looking to the left to see the moving traffic, you reach the middle of the street you will feel that you have to look to the right, even though you know that no traffic can come from that direction.

If you do not come to feel that, observance of the traffic rules has not become your habit, even though you may know them.

Good everyday and occupational habits greatly facilitate life and work. Habits strengthen friendship and love. Unfortunately, however, people have not only good habits, but also bad ones, which must be controlled.

Nor should everything be done only by force of habit which often impedes our quests and creative endeavours. One must not live "by habit". A Russian proverb says that "to go through life is not like crossing a field". And it is certainly not like crossing a street.

IMAGINARY ACTS

Kharlampiyev, wrestler and Honoured Master of Sports, fell ill before a contest and was confined to bed for quite some time. However, he did not give up the contest and, what is more, much to everybody's surprise, he was in such excellent condition that he won the championship of Moscow. How did he do it?

The fact is that while the athlete was in bed he persistently trained and wrestled ... mentally. Under those conditions he probably very carefully and in great detail considered all the holds and tactics used by his opponent, as well as his own.

While still a conservatoire student, Isaak Mikhnovsky, a pianist, had no instrument; however, he prepared Chaikovsky's *Seasons* for rendition by learning to play the pieces only in his imagination.

My pupil Vladimir Yakovlevich Dymersky, a flyer who had not flown for a long time, restored his flying skills, lost through disuse, by systematically making imaginary flights. The people at the flying club could hardly believe that he had not flown for so long.

I strongly advise not only athletes but also everybody who wants to restore his motor skills or to avoid losing them through long disuse to profit by this experience.

THE HANDS AND THE HEAD

"The process of social and cultural development of people operates normally only when the hands teach the head, the wiser head teaches the hands and the wise hands again and to a greater extent contribute to the development of the brain," said Gorky. In other words, man gets the greatest satisfaction from a combination of physical and mental work. Pavlov implied this in his letter to the Rally of the Donets Basin Miners in 1936.

The class society gave rise not only to differences, but also to a contradiction between physical and mental work, making the latter a privilege of the ruling class. Socialism has eliminated this contradiction by making all work creative.

31.12.1935

Уважаемые товарищи!

Всю мою жизнь я люблю и люблю учиться -
и физический и, пожалуй, даже больше
второй. А особенно чувствую себя удовлетворен-
ным, когда в последний выдох как-то - иду! хоро-
шо догадываюсь, т.е. соединяю голову с руками. И
попаю на эту дорожку. От души желаю Вам и
далше двигаться по этой, единственно правильной
и скажем так, дорожке.

(с искренним уважением)

Иван Павлов, академик.

I. P. PAVLOV'S LETTER TO MINERS

Driving an automobile will continue to be physical work also under communism, while writing poetry will continue to be mental work. But already in our days a chauffeur writes poetry and a poet drives an automobile.

Under communism there will be no healthy people doing only mental or only physical work. But already now, in socialist society, only those who do not want to, fail properly to combine mental and physical work, owing to which they, incidentally, only harm themselves.

ARTIST'S WORK

Many discussions are conducted concerning the different trends in art. I remember a discussion that took place in the 1920s and the words uttered by a psychologist.

"Works of art can be distinguished from counterfeit," he said, "by four signs. But necessarily by all four of them."

"*First Sign.* Any work of art must express the artist's thoughts and feelings, i.e., it must carry some message.

"*Second Sign.* The artist may express his thoughts and feelings in any form, but in his own way and not in a stereotyped manner as was already done many times before him; he must do it sincerely, without affectation.

"Third Sign. A work of art must awaken in most spectators and hearers their own thoughts and feelings, i.e., it must be comprehensible to the people; it must be 'readable'.

"Fourth Sign. The thoughts and feelings which a work of art awakens must be necessary for the people, i.e., they must be progressive.

"Art is joint activity of the artist and spectator. While creating, the artist works with his future spectator. Perceiving a work of art the spectator continues the artist's work, adding to it his own thoughts and experiences."

I think he was right. What do you think?

IS FATIGUE HARMFUL?

Will people develop fatigue under communism? Of course, they will. Fatigue is a regular physiological condition of temporary diminution in the working capacity of the organism or an organ resulting from activity. It is a normal and useful reaction to any activity. A healthy person doing interesting, fascinating work may not feel fatigue, whereas a sick person may feel tired even without working.

If a person avoids getting tired, he not only fails to develop his endurance which is closely connected with man's volitional qualities, but even does himself harm.

One of my table mates at a holiday-home was a stout man who complained of insomnia and lack of appetite. He had been at the holiday-home for three weeks and never did anything to get tired. All day long he sat in an armchair looking through a comic magazine. I didn't know whether his idleness had made him ill or his illness was manifested in his idleness but I was sure he would never get well unless he started getting tired. Nobody else had to be forced to go walking. We all walked and got tired because a normal person has a need for fatigue. The healthier and younger the person, the greater this need. During our walks we would sit down to rest because every tired person needs a rest.

Class society has upset the proper relations of fatigue and rest, and only the socialist society has given the workers the right to rest. What we will not have under communism is overfatigue. Marked overfatigue has already become a rare occurrence in the Soviet Union.

Overfatigue, or accumulated fatigue, appears when the proper relation between fatigue and rest is disturbed and rest does not eliminate fatigue. Fatigue accumulating during the day must be eliminated at night. If any remnants of fatigue are retained during the week, there is a weekly day-off to eliminate it.

The Soviet Union will have the world's shortest workday and workweek. Properly organised weekly work and rest usually make it possible to utilise the day-off and the vacation not to eliminate fatigue, but to prevent it from developing, to build up health and to improve physical and mental development.

SECHENOV'S PHENOMENON

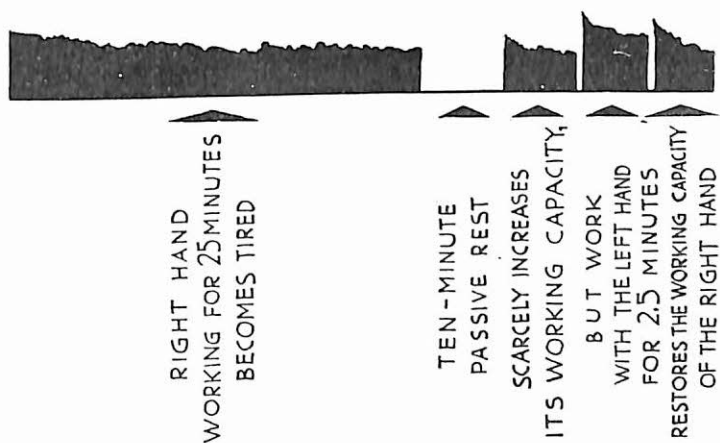
The work of lifting a weight with a finger or hand can be recorded on an instrument called an ergograph. In 1901 Sechenov performed an experiment and obtained paradoxical results.

He thus described the experiment which has gone down in science as Sechenov's phenomenon and has formed the basis of the theory of active rest:

"I compared on the twice-fatigued right hand the results of two influences—simple rest and rest of the same duration, but combined with

I. M. SECHENOV'S EXPERIMENT (1901) THAT FORMED THE BASIS OF THE THEORY OF ACTIVE REST

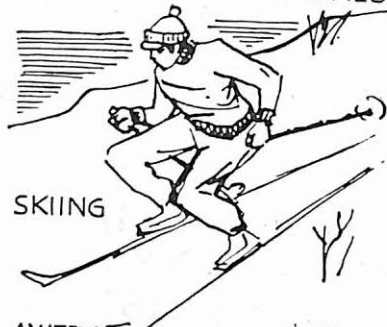
RECORD OF THE MOVEMENTS OF THE HAND LIFTING A WEIGHT



ACTIVE REST



ATHLETIC GAMES



SKIING



AMATEUR
ART ACTIVITIES



ENTERTAINMENT



IS THE BEST REST

work of the other hand. I was particularly surprised to find that the fatigued right hand was capable of much greater exertion after the work done by the left hand than it had been after the first period of rest."

REST

Sleep is the best rest, but it must be supplemented by other forms of rest.

Fatigue may be physical, mental and emotional. The different forms of fatigue require different forms of rest.

However, a change in activity, some form of relaxation of emotional tension is necessary in any form of fatigue. It is generally necessary in any form of activity.

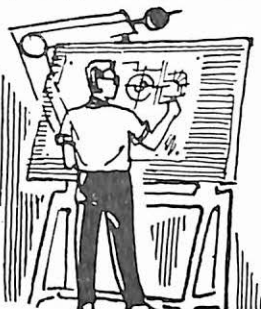
V. I. Lenin wrote the following to his sister M. I. Ulyanova who was in prison:

"I also advise you to arrange your time according to your books so that you may vary your reading. I very well remember that a change in reading—from serious reading to fiction—or from reading to translation, and from writing to physical exercise is extraordinarily helpful. Sometimes a

DIFFERENT FORMS OF FATIGUE



PHYSICAL

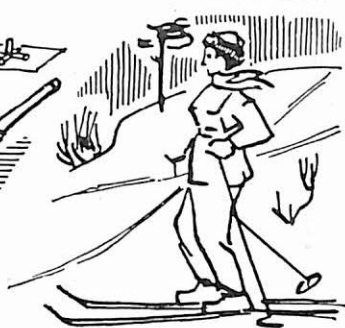


MENTAL



EMOTIONAL

REQUIRE DIFFERENT FORMS OF REST



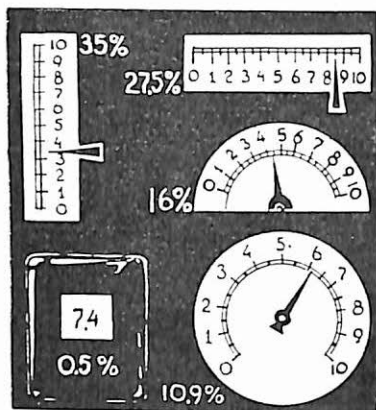
deterioration of one's mood, which is quite changeable in prison, is merely due to fatigue produced by monotonous impressions or monotonous work, and it suffices to change it to get back to normal and to keep one's nerves in check."

MACHINE AND MAN

"What beautiful instruments," said a girl admiring the dashboard in a taxi.

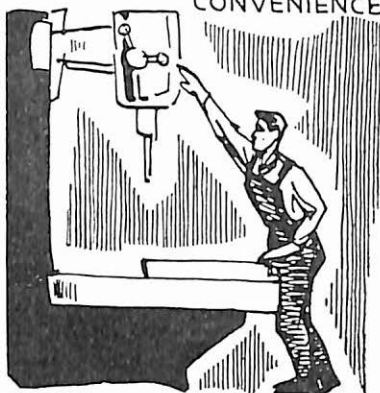
"Beautiful, but inconvenient," the chauffeur rejoined. "One has to read these instruments, not admire them. For example, what do I want with this big clock before my eyes? But look at these red figures showing the hundreds of metres on the speedometer; they are made so that they can't be seen at all. They should have given more thought to the chauffeur's convenience than to beauty."

ENGINEERING PSYCHOLOGY STUDIES THE SUITABILITY OF MACHINES TO MAN

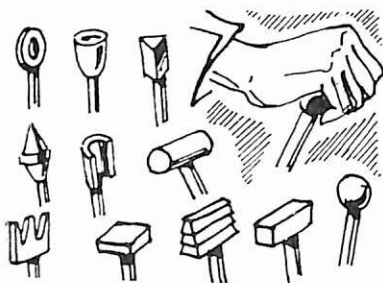


PER CENT OF ERRORS
IN RAPID READING

DESIGNER WHO DOES NOT
CONSIDER THE WORKER'S
CONVENIENCE

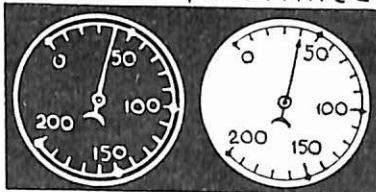


DESERVES CENSURE



DIFFERENTLY SHAPED LEVERS
ARE HARD TO CONFUSE

INSTRUMENTS ARE BEST READ
AT A LONG DISTANCE AT A SHORT DISTANCE



WHITE ON BLACK

BLACK ON WHITE

He was absolutely right. Until recently the engineering industry hardly ever considered human convenience. The worker has always had to adapt himself to the machine. This also revealed the traditions of capitalist production concerned mainly with raising labour productivity by its intensification, the weakness of the engineering industry and the failings of labour psychology as a branch of general psychology. In socialist society this state of affairs is absolutely intolerable and such cases are unpardonable.

Only recently when, for example, the design of a new aircraft was discussed, the discussions were always accompanied by arguments about the instruments to be installed.

Now this problem is solved by engineering psychology—a rapidly developing branch of general psychology. Say, the speed and precision of reading various types of instruments or discrimination by touch of handles of control levers are investigated; in such cases an experiment settles all arguments by furnishing the mean values.

MAN AND MACHINE

The “discussions between the physicists and lyrics” in our group of vacationists continued. Teasing Gera for his enthusiasm for cybernetics Lena recited:

*In nightmare dreams my fancy sometimes pictures
A giant electronic rhyme-computer
With bronze and nickel, glass and tungsten all aglow.
The poet feeds his themes into its mouth:
“Spring”, “Love”, “Delightful landscape”, “Jealousy” . . .
On clicks the switch, and then arises
A buzzing like a bumblebee’s, but deeper,
And instantly upon a sheet of paper
Appear the only necessary words.
Meanwhile the poet, in a cosy working outfit,
Tunes the controls or tightens up the clamps,
Or, business-like, applies new polish
To some already glittering device,
So that towards the evening,
Enjoying well-earned leisure with his colleagues,
He may exclaim between two sips of beer,
“It was a good day’s work I did, by Jove!
Ten thousand lines—no more, no less!”
It doesn’t seem so far removed, that time.
For quite a deal of poets even now
Produce chef-d’oeuvres much like a computer’s!
It makes you shudder just to think of it.
Yet even then, methinks, in that protonik-electronic age
There’ll be a crank or two who will spend hours
At an antiquary’s, exhuming in a frenzy
Some handmade poetry left from the days of yore . . .*

“It is sceptics like you who impede the development of science,” Gera said excitedly. “Don’t you understand that, whereas formerly machines

were a continuation of our hands and sense organs, today electronic machines are becoming the continuation of our brain. An electronic computer can calculate thousands of times as fast as the human brain. Even the old Romans used to say that 'to err is human'. But an electronic brain never errs. A robot's reactions are a thousand times as fast as those of man.

"It took the British mathematician Shanks about 15 years to calculate the π to the 707th decimal place, whereas an electronic computer has calculated it to the 2,048th place in less than a day. Electronic memory, with all its qualities, including its readiness, is much more productive than that of man. It does not forget anything. A robot can be so constructed as to do simultaneously and equally well as many things as necessary, whereas man's ability to distribute his attention is very limited."

In this discussion both parties were right. All the enumerated advantages of electronic computers over the human brain are obvious. A robot can do better than man the operations whose success is determined by speed, strength, endurance, resistance to external factors unfavourable to man, calculations by even the most complex formulas, and simultaneous performance of several different operations. Two more arguments may be cited in favour of cybernetics.

The correctness of the principal thesis of cybernetics that wherever the processes of control may operate—in a mechanism or in an organism—and however they may differ they are always subject to some common laws is incontestable. Cybernetic models help better to understand the work of the human brain. The method of modelling has always enriched science.

The second and often forgotten argument is that cybernetics is still a very young science. It is known to have come into existence in 1948, and we must not therefore measure its potentialities only by its present level.

But Vladimir Lifshits' verses recited by Lena also contain the truth. It is not a question of the most complex electronic computer having at most 10^4 - 10^6 valves, whereas the human brain has more than 10^{10} nerve cells, and of the sensitivity of the analysers being greater than that of the existing devices. The brain is really "the finest and most perfect apparatus on the Earth" as Pavlov put it. But these differences between the human brain and the electronic machine, as also their sizes, are for the most part only quantitative. Much more important are their qualitative differences.

Electronic engineering has to go a long way to make an electronic bee and model all its instincts. It is possible that it will achieve this. But there are qualitative differences between the human brain and a machine that will never be overcome.

Just as the physicist may confidently say that nobody will ever build a perpetual motion engine and as the mathematician may say that nobody

will ever square a circle with a ruler and compasses, so may the psychologist say that no machine built by man will ever go beyond the line that separates the bee from the architect. And this line is the property developed by the substance of the human brain in the process of all the preceding evolution of matter, the property of consciousness as the highest form of reflection of the real world, the property of inspiration and creativeness which ensure man's increasingly greater domination over nature.

Man has long since strengthened his hands and muscles and has made his sense organs keener with machines. Machines have long been helping man to think. Electronic computers perform more operations and much faster than it is possible with the abacus and the arithmometer. By developing increasingly more complex machines man will transfer to them all they will be able to do with the result that man—and only man!—will have the more opportunities to think, feel, create and dare.

MAN OF THE FUTURE

Three points enable us to see the continuation of the line that connects them with greater certainty than do two points.

The direction of the line along which the human mentality is developing can be seen from a comparison of the people of the capitalist and socialist worlds. We can already clearly see the third point—the mental traits of the man of the communist future—in the persons of the Hero of Socialist Labour Valentina Gaganova and her numerous followers, as well as in the persons of the members of the teams, enterprises and shops of communist labour.

These traits are consolidated by the moral code of the builders of communism. The Programme of the Communist Party of the Soviet Union adopted at the 22nd Congress reads: *"The period of transition to communism offers greater possibilities for educating the new man who harmoniously combines spiritual wealth, moral purity and physical perfection."*

Great moral substance, high principles, purposefulness, initiative, optimism, self-criticism, collectivism, discipline and an indomitable striving to advance—all these traits will develop in depth and extent in the builders of communism and will become the most typical traits of the personality of the new man.

But let us continue the line beyond these three points. Let us try to look into the soul of the man of the more distant future, the man for whom we, Dear Readers, shall be as remote as Homer is from us.

To do this, we shall draw for help on the immutable law of development of the human mind, namely that being determines consciousness. And, if we agree that the being of the man under consideration will be about as it is usually described by science-fiction writers, we shall not have so much difficulty in conceiving the consciousness of this man, the man of the era of the Great Ring, who has established contact with other conscious inhabitants of the cosmos.

The abundance of material goods and the resultant hygienic conditions and proper training from the very first days of life will favourably influence not only the physical and neuropsychic health, but also the temperament of man. The strong, mobile and balanced type of nervous system will predominate.

The education which will continue all through man's life and will be connected with work will be aimed not at memorising various information (this will necessarily be taken over by machines with electronic memory), but at methods of operating with already known facts and with finding new ones.

The harmonious combination and alternation of various forms of mental and physical work will lead to all-round development of human abilities and talents and, consequently, to strengthening man's individual differences. The people will resemble each other even less than they do today. But this does not in any way mean that some of them will be "better" than others. And this is not so difficult to conceive as it may seem.

Imagine a society consisting of the best known scientists, inventors, writers, agronomists, workers, artists, teachers, etc. Could anybody say that among them Newton and Mozart, Michurin and Glinka are better or worse than Raphael, Mendeleyev, Goethe, Voltaire or Edison?

But the world of human needs and interests will change very essentially. Before the Great October Revolution in our country man developed in a society with antagonistic classes, violence and wars, whereas the man joining the Great Ring of inhabitants of the cosmic nebulae will be preceded by a number of generations grown up under the favourable conditions of communism. Human consciousness, science, engineering and economy will develop at a continuously increasing rate.

Since consciousness always lags behind the changing being (at least during the era of mankind under consideration) survivals not only of socialism (very rarely), but even of capitalism will sometimes have to manifest themselves in the consciousness of man, the member of the society which has long since built communism. It may be assumed that the most typical survival will be an evaluation of oneself and others by the quality of work done. "To each according to his work"—the slogan inscribed on the banner of socialism will die off in the economy of communism before it does in human consciousness.

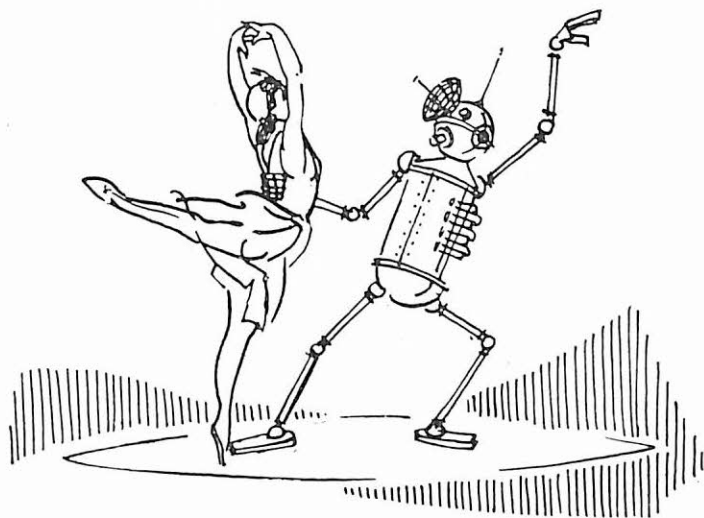
That is why so progressive a feeling of emulation as existed under socialism and was associated with the evaluation of man by the results of his work will sometimes also be a mere survival. Under communism the feeling of emulation will persist as the moving force in the development of consciousness, but it will assume more complex forms whose prototype is already seen in amateur art and athletic contests.

People will begin emulation in active development of various abilities and the beauty of their spiritual make-up.

Everybody will try to become better not for himself, but for others. The feeling of emulation will be like the one now experienced by a teacher who has been surpassed by his pupil. The man of communism will rejoice in all cases of being surpassed because the joy of victory scored only by his pupil will also have become a survival.

The feeling of "my own" will persist the longest and maybe forever only in the mother for her child. Yet there will be no difference between the attitude to one's own and that to someone else's child since this is even today a survival of feudalism. But the emotional reactions of the mothers of children flying away to other galaxies will be finer and more differentiated as will also be all feelings of the man of the future.

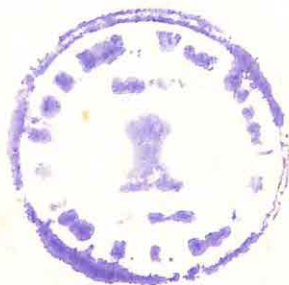
By eliminating the contradiction between mental and physical work man will also be able to overcome that between emotion and reason.



TO THE READER

Progress Publishers would be glad to have your opinion of the translation and the design of this book.

Please send your comments to 21, Zubovskiy Boulevard, Moscow, U.S.S.R.



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